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Sport Fishery Abstracts

An abstracting service for fishery research and management

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of papers on limnology, ecology, natural history and other fields of specialization will be included when the subject has application to the conservation of sport fish and the restoration of sport fishing.

One volume consisting of not more than four numbers will be issued each year. Each number contains separate Author and Subject indexes, with the final number of each volume containing cumulative indexes. The last number of each volume contains a list of publications screened for appropriate material.

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7755. Rearden, Jim. 1965. NEW: A BIG LIFT FOR SALMON. Outdoor Life, 136(1): 26-28, 79.

Steep-pass units over falls six to ten feet high have proved satisfactory for migrating salmon and other fish. They are easily transported and not expensive. Plans may be obtained from the Alaska Department of Fish and Game.

7756. Croker, Robert A. (Emory University, Atlanta, Georgia). 1965. PLANKTONIC FISH EGGS AND LARVAE OF SANDY HOOK ESTUARY. Chesapeake Science, 6(2): pp. 92-95.

Twenty species of planktonic fish eggs and larvae were identified from 75 surface plankton tows made at river, bay, and ocean locations in the Sandy Hook estuary. A gradual increase in the number of species through the spring to a peak in the summer was followed by a decline in the fall and winter. Seventeen species were collected at a location where the Navesink River joins with Sandy Hook Bay. Seven species: American eel, Atlantic herring, American sand lance, winter flounder, bay anchovy, northern pipefish, and Atlantic silverside made up 98% of all larvae collected. Winter flounder were most ubiquitous and exhibited a marked diel variation in abundance. The most abundant eggs were those of searobin and Atlantic menhaden. Larvae of several species were collected whose adults are either summer or winter visitors to inshore waters. (Author)

7757. Richards, C. E. (Virginia Institute of Marine Science, Gloucester Point). 1965. AVAILABILITY PATTERNS OF MARINE FISHES CAUGHT BY CHARTER BOATS OPERATING OFF VIRGINIA'S EASTERN SHORE, 1955-1962. Chesapeake Science, 6(2): pp. 96-108.

Catch data logged by charter boat captains fishing off Virginia's Eastern Shore from 1955 reflect seasonality, migrational patterns, and population trends of species caught. Nineteen percent of 2,369 trips recorded were for offshore "big game" species, 31% of the trips were for inshore "big game" species, and 50% of the trips were for the smaller game fishes. Seasonal patterns and catch data for bluefish, cobia, dolphin, weakfish, kingfish, Atlantic croaker, black and red drum, little tuna, Atlantic bonito, bluefin tuna, white marlin, summer flounder, and black sea bass are given. A disscussion of factors affecting catch rate data is presented and related to these charter boat catches. (Author)

7758. Eisler, Ronald (U.S. Bur. of Sport Fisheries and Wildlife, Highlands, New Jersey). 1965. ERYTHROCYTE COUNTS AND HEMOGLOBIN CONTENT IN NINE SPECIES OF MARINE TELEOSTS. Chesapeake Science, 6(2): 119-120.

Mean erythrocyte number per mm^3 of blood among nine species of fishes studied ranged from 680,000 for toadfish to 4,120,000 for white perch. Intermediate values were obtained for eel (2,020,000), searobin, flounder, blackfish, puffer, scup, and bluefish (3,830,000) in that order. In general, fishes which lead a comparatively sedentary existence possess fewer erythrocytes and less hemoglobin per unit volume of blood than the more active types. Within each species, a statistically significant correlation exists between erythrocyte number and hemoglobin content. (Author)

7759. Lorz, H. W. and T. G. Northcote (Fish and Game Br., British Columbia Dept. of Recreation and Conservation, and Inst. of Fisheries, Univ. of British Columbia, Vancouver). 1965. FACTORS AFFECTING STREAM LOCATION, AND TIMING AND INTENSITY OF ENTRY BY SPAWNING KOKANEE (ONCORHYNCHUS NERKA) INTO AN INLET OF NICOLA LAKE, BRITISH COLUMBIA. Journal of the Fisheries Research Board of Canada, 22(3): 665-687.

Diel fluctuations in onshore-offshore movement of mature kokanee occurring at the northeast end of Nicola Lake adjacent to a spawning stream were related to differences in wind action, which thereby affected daily numbers of kokanee entering this stream. Nasal occlusion experiments indicated that olfaction was used in location of the stream by kokanee. Entry into the stream occurred largely from dusk to midnight and appeared to be related to changes in light intensity rather than temperature. Average length of spawning kokanee (sexes combined) ranged between 225.9 mm from 1958 to 1963 with marked annual differences. Most kokanee spawned in their third year (2 +) although some were in their second and fourth years (1 + and 3 +). About equal numbers of both sexes occurred in the spawning population; males were more abundant at the onset of the migration while females were predominant towards the end. (Authors)

7760. Applegate, Vernon C. and M. L. H. Thomas (U.S. Bur. of Commercial Fisheries Biological Station, Sandusky, Ohio). 1965. SEX RATIOS AND SEXUAL DIMORPHISM AMONG RECENTLY TRANSFORMED SEA LAMPREYS, PETROMYZON MARINUS LINNAEUS. Journal of the Fisheries Research Board of Canada, 22(3): 695-711.

The sex, length, and weight were determined of nearly all recently transformed sea lampreys migrating downstream in the Carp Lake River, Michigan, in the fall, winter, and spring of 1960-61. Similar data were collected from samples of an earlier run in the Carp Lake River and of runs in three other tributaries of Lakes Huron and Michigan. The sex ratio of the 1960-61 migrants in the Carp Lake River was 324 males: 100 females. Sex ratios of migrants in the other runs varied from 77 to 86 males: 100 females. The high proportion of males in the 1960-61 run in the Carp Lake River is attributed to the effective prevention of recruitment of sea lampreys in the river and transformation of the females at an earlier age than is characteristic of the males. A near equal sex ratio among recently transformed migrants is considered normal for the species. The sex composition of a run changed during the period of migration. The proportion of males among the migrants was greatest at the beginning of the run and declined steadily thereafter. The average size was smaller for males than for females. Differences in the mean lengths and weights of the sexes were statistically

significant. The length-weight relation differed for the sexes and showed a slower rate of increase of weight with increase in length than is characteristic of other stages of the animals' life cycle. Seasonal changes in the length-weight relation had a trend toward lower weights among the migrants coming downstream in the later months of the run. (Authors)

7761. Ross, A. J. and G. W. Klontz (U.S. Bur. of Sport Fisheries and Wildlife, Western Fish Disease Lab., Seattle, Wash.). 1965. ORAL IMMUNIZATION OF RAINBOW TROUT (SALMO GAIRDNERI) AGAINST AN ETIOLOGIC AGENT OF "REDMOUTH DISEASE". Journal of the Fisheries Research Board of Canada, 22(3): 713-719.

Rainbow trout were fed a pelleted diet containing killed cells of the etiologic agent of a bacterial disease, redmouth. These fish in addition to appropriate controls were subsequently challenged with virulent homologous organisms. Ninety percent of the redmouth immunized fish survived the basic challenge using virulent organisms in contrast to 20% survival for the controls. Multiple challenge doses at increased levels also are discussed. (Authors)

7762. Nelson, J. S. (Univ. of Alberta, Edmonton, Alberta, Canada). 1965. EFFECTS OF FISH INTRODUCTIONS AND HYDROELECTRIC DEVELOPMENT ON FISHES IN THE KANANASKIS RIVER SYSTEM, ALBERTA. Jour. Fisheries Research Board of Canada, 22(3): 721-753.

Changes occurred in the abundance and distribution of fishes in the Kananaskis River system, Alberta, in conjunction with fish introductions and hydroelectric development data from surveys from 1936 to 1961 indicate the probable chronology of events.

Dolly Varden (Salvelinus malma), brook trout (S. fontinalis), cutthroat trout (Salmo clarkii), and rainbow trout (S. gairdneri) decreased in abundance, probably due to the introduction of brown trout (Salmo trutta), longnose suckers (Catostomus catostomus), and white suckers (C. commersonii), to the cooling of the Kananaskis River from reservoir construction, and to sport fishing. Hybridization between rainbow and cutthroat trout was also important in the decrease of the latter species. After introduction by man, brown trout, rainbow trout, longnose suckers, white suckers, lake chub (Hybopsis plumbea), and longnose dace (Rhinichthys cataractae) greatly increased in abundance. Prior to the increase in numbers of white suckers, a reduction in the numbers of longnose suckers occurred in Lower Kananaskis Reservoir. Little change in the distribution of mountain whitefish (Prosopium williamsoni), longnose dace, and brook sticklebacks (Culaea(=Eucalia) inconstans) occurred over the 25 years. Changes in the physicochemical environment and invertebrate fauna in the reservoirs appeared to be of secondary importance to the interaction among fish in causing the changes in species abundan and distribution. (Author)

7763. Hoffert, J. Russell and Paul O. Fromm (Michigan State Univ., East Lansing). 1965. BIOMICROSCOPIC, GROSS, AND MICROSCOPIC OBSERVATIONS OF CORNEAL LESIONS IN THE LAKE TROUT, (SALVELINUS NAMAYCUSH). Jour. Fisheries Research Board of Canada, 22(3): 761-766.

A description has been given of a corneal lesion which occurs in hatchery-reared lake trout. The lesion is characterized by a general cloudiness of the cornea leading to marked epithelial erosion. A secondary inflammatory response with pigment migration and uveitis is observed. The condition terminates in endophthalmitis and complete loss of the functional eye and destruction of choroid, retina, lens, and iris. Although many factors may be involved, the osmotic gradients to which the freshwater teleost eye is exposed are believed to play a vital role in the development of this corneal pathology. (Authors)

7764. Tsuyuki, H. and Eve Roberts (Fisheries Research Board of Canada, Tech. Res. Lab., Vancouver, B.C.). 1965. ZONE ELECTROPHORETIC COMPARISON OF MUSCLE MYOGENS AND BLOOD PROTEINS OF ARTIFICIAL HYBRIDS OF SALMONIDAE WITH THEIR PARENTAL SPECIES. Jour. Fisheries Research Board of Canada, 22(3): 767-773.

Starch-gel zone electropherograms of the muscle myogen and blood hemoglobins and disc electropherograms of the serum proteins of a number of artificial hybrids involving the Salmo, Salvelinus, and Cristivomer genera are compared to their respective parental species. The pattern variations observed in the serum proteins and muscle myogens in many of the parental species are discussed in relation to the frequent variations obtained in F_1-hybrid patterns. The necessity is pointed out for defining biochemical as well as morphological uniformity of parent species used for artificial hybridization studies, particularly as freshwater species of fishes, in contrast to marine species, frequently hybridize in nature or have hybridized in recent history, judging from the variations in their protein patterns. The extent of known hybridizations in nature, which are indistinguishable morphologically but are frequently manifested at the molecular level as variations in protein patterns, and the usefulness of biochemical techniques in spotting these breakdowns of species lines, are discussed. (Authors)

7765. McBride, J. R., U. H. M. Fagerlund, M. Smith, and N. Tomlinson (Fisheries Research Board of Canada, Tech. Res. Lab., Vancouver, B.C.). 1965. POST-SPAWNING DEATH OF PACIFIC SALMON: SOCKEYE SALMON (ONCORHYNCHUS NERKA) MATURING AND SPAWNING IN CAPTIVITY. Jour. Fisheries Research Board of Canada, 22(3): 775-782.

It has been shown that sockeye salmon, Oncorhynchus nerka, will start to eat soon after capture during their freshwater spawning migration. Some will continue to eat up to, during, and after spawning, while others stop eating shortly before spawning.

The effect of feeding has been investigated histologically in a number of tissues by comparison of feeding fish, unfed controls, and fish spawned in the wild. Atrophy, and often degeneration of the liver, stomach, and intestine in post-spawned unfed controls and fish spawned in the wild was equally marked, but was absent or much less pronounced in fed fish. (Authors)

7766. Pratt, David M. (Univ. of Rhode Island, Kingston). 1965. THE WINTER-SPRING DIATOM FLOWERING IN NARRAGANSETT BAY. Limnology and Oceanography, 10(2): 173-184.

Weekly observations of phosphate, nitrate, silicate, and phytoplankton over a 4-1/2-year period are analyzed to explain year-to-year variations in the time of inception and magnitude of the winter-spring diatom flowering in Narragansett Bay, Rhode Island. The population during this period (November-June) is dominated by Skeletonema costatum. The start of growth does not appear to be related to stability, temperature, or incident radiation; Martin (1965) has shown that it is triggered by the release of zooplankton grazing pressure. The diatom maximum is independent of temperature and incident radiation, and it is regulated by the concentrations of nitrate and silicate at the beginning of logarithmic growth, which also influences the magnitude of that part of the flowering that follows the winter maximum. In most years, considerable growth takes place after the exhaustion of nitrate, whereas growth was never observed to continue after silicate depletion. The relative importance and interplay of silicate and nitrogen as limiting factors are discussed. Since the flowering is greater the earlier it begins, its success is to some degree predetermined by zooplankton activity in the fall. (Author)

7767. Martin, John H. (Univ. of Rhode Island, Kingston). 1965. PHYTOPLANKTON-ZOOPLANKTON RELATIONSHIPS IN NARRAGANSETT BAY. Limnology and Oceanography, 10(2): 185-191.

Zooplankton samples collected every other week in upper and lower Narragansett Bay, Rhode Island, were analyzed quantitatively and qualitatively. The seasonal occurrence and abundance of the various species identified and enumerated in the present study are presented in tabular form.

Analysis of the relative abundance of the principal grazers in the zooplankton population (Acartia tonsa, A. clausi, and Oithona spp.) and of the dominant phytoplankton species, Skeletonema costatum, upon which these copepods are believed to graze preferentially, shows that the seasonal changes in phytoplankton abundance are to a considerable extent attributable to differential grazing pressures.

Concentrations of plant nutrients (nitrate, phosphate, and silicate) were compared with zooplankton numbers. It is believed that the large summer-fall zooplankton population contributes to the phosphate maximum and possibly indirectly to the nitrate maximum as well. (Author)

7768. Beeton, Alfred M. (U.S. Bur. of Commercial Fisheries, Ann Arbor, Mich.). 1965. EUTROPHICATION OF THE ST. LAWRENCE GREAT LAKES. Limnology and Oceanography, 10(2): 240-254.

Lakes Huron, Michigan, and Superior are classified as oligotrophic lakes on the basis of their biological, chemical, and physical characteristics. Lake Ontario, although rich in nutrients, is morphometrically oligotrophic or mesotrophic because of its large area of deep water. Lake Erie, the most productive of the lakes and shallowest, is eutrophic. Several changes commonly associated with eutrophication in small lakes have been observed in the Great Lakes. These changes apparently reflect accelerated eutrophication in the Great Lakes due to man's activity. Chemical data compiled from a number of sources, dating as early as 1854, indicate a progressive increase in the concentrations of various major ions and total dissolved solids in all of the lakes except Lake Superior. The plankton has changed somewhat in Lake Michigan and the plankton, benthos, and fish populations of Lake Erie are greatly different today from those of the past. An extensive area of hypolimnetic water of Lake Erie has developed low dissolved oxygen concentrations in late summer within recent years. (Author)

7769. Gard, Richard and Donald W. Seegrist. 1965. PERSISTENCE OF THE NATIVE RAINBOW TROUT TYPE FOLLOWING INTRODUCTION OF HATCHERY TROUT. Copeia, No. 2, pp. 182-185.

The Santa Ana River, California, originally contained native coast rainbow trout, but repeated introductions of hatchery-reared rainbow trout and Lahontan cutthroat trout have subsequently been made. Twenty-four morphological characters of samples of native coast rainbow trout, hatchery-reared rainbow trout, and cutthroat trout, and recent Santa Ana River rainbow trout were compared using the D^2 statistic to determine the extent that the native type was modified by introductions. The character mean of the recent Santa Ana sample was 10.8 D^2 units away from that of the cutthroat trout sample, 7.3 units from the hatchery-reared rainbow trout sample mean, but only 3.0 units from the native rainbow trout sample mean. Pure Lahontan cutthroat trout have disappeared from the Santa Ana River and trout recently occupying this river closely resemble the native coast rainbow trout. (Authors)

7770. Clemens, Howard P. and F. Blake Grant. 1965. THE SEMINAL THINNING RESPONSE OF CARP (CYPRINUS CARPIO) AND RAINBOW TROUT (SALMO GAIRDNERII) AFTER INJECTIONS OF PITUITARY EXTRACTS. Copeia, No. 2, pp. 174-177.

Twenty-four hours after an intraperitoneal injection of aqueous extracts of acetone-dried carp pituitary glands, the semen of previously reproductively quiescent carp increased similar to that commonly observed in fish immediately before or during spawning. Similar results were obtained with rainbow trout injected either with an extract of bigmouth buffalo (Ictiobus cyprinellus) pituitaries, or with chorionic gonadotropin. In this ripening

process of out-of-season fishes, the rapid and extensive seminal thinning was studied by cell counts, seminal plasma percentage, relative water percentage, relative seminal plasma osmolarity, and seminal plasma sodium, potassium, magnesium, and calcium. The fluidity of the semen, reflected in a linear relationship between sperm cell count and relative water content, increased in direct proportion to the logarithm of the dose in the range 0.22 to 22.0 µg/g. Although total osmotic pressure decreased with increasing fluidity, the ionic concentrations of sodium, potassium, magnesium, and calcium were unchanged, implicating depletion of osmotically active organic substances. (Authors)

7771. Mills, D. H. (Freshwater Fisheries Lab., Pitlochry, Scotland). 1965. THE DISTRIBUTION AND FOOD OF THE CORMORANT IN SCOTTISH INLAND WATERS. Dept. of Agriculture and Fisheries for Scotland, Freshwater and Salmon Fisheries Research No. 35, 16 p.

Examination of the contents of 129 cormorant stomachs from Scottish inland waters reveals that cormorants fishing on lochs feed on brown trout, perch, and young salmon in that order. Cormorants fishing on rivers feed most often on brown trout, young salmon and eels. They also feed on three-spined sticklebacks, flounders, pike and sea trout. Brown trout of up to 2-1/2 pounds were recorded from cormorant stomachs.

It is considered that cormorant predation on salmonid fish stocks is most likely to affect the brown trout population and because of the size of the brown trout eaten, this predation affects the catchable stock of brown trout.

Information on the diet of cormorants on estuaries is limited and a more detailed study is necessary before any conclusions can be drawn.

It is concluded that the cormorant is not a serious predator of young salmon. However, because predation affects the catchable stock of brown trout, control may be beneficial where cormorant numbers on trout lochs are high. Bounty payments are considered to be valueless. (Author)

7772. Waters, Thomas F. (Univ. of Minnesota, St. Paul). 1965. INTERPRETATION OF INVERTEBRATE DRIFT IN STREAMS. Ecology, 46(3): 327-334.

Various experiments were conducted in a small Minnesota trout stream to determine if data on the drift of stream invertebrates obtained with stationary nets set in the stream, may be interpreted as indication of permanent downstream displacement. A mayfly, Baetis vagans McDunnough, and the scud, Gammarus limnaeus Smith, were the two species primarily involved in the drift. Drifting invertebrates were collected in arrays of several shallow nets stacked on their supporting rods to obtain the vertical distribution of the drift through the water column. Both species entered the drift nets, not only along the stream bottom, but in all water strata. A comparison of the standing crops with drift net accumulations indicated that the drift was too large to be supplied only by the standing crops in the vicinity of the drift nets and that the organisms must have drifted down from upstream areas. Measurement of the dispersal of organisms moving into a denuded stream bottom area, alternately open to movement from upstream and downstream, indicated that both species did so primarily at night and from upstream. Experimentally blocking the drift with nets set from bank to bank reduced daily drift rates downstream from the block position through a distance of 38 m, including two riffles and an intervening pool, indicating that the organisms normally dirfted through at least this distance. In general, it appears that the accumulation of organisms in drift nets is the result of a permanent displacement of the organisms downstream, and not the result of non-directional activity in the immediate vicinity of the nets. (Author)

7773. Cushing, Edward J. and H. E. Wright, Jr. (Univ. of Minnesota, Minneapolis). 1965. HAND-OPERATED PISTON CORERS FOR LAKE SEDIMENTS. Ecology, 46(3): 380-384.

A modification of the Livingstone sampler, a thin-wall core sampler with stationary piston, will obtain long and undeformed cores of sediment from shallow lakes, with core diameters of 1 to 2 inches. Cores of 4-inch diameter up to 1-1/2 m long can be taken with a piston sampler of slightly different design. The utility of both samplers is greatly extended by their use in combination with a drive frame and two lightweight chain hoists, which can provide up to 2 tons of force for driving and withdrawing the samplers. (Authors)

7774. Langlois, Thomas H. 1965. PORTAGE RIVER WATERSHED AND FISHERY. Ohio Dept. of Natural Resources, Publication W-130, 22 p.

The present drainage of the Portage River was determined by the Wisconsin Glacier, its weight on the eastern end of Lake Erie up-tilted the western end causing the river to cut a new channel to reach the lake. This new mouth, presently identified as West Harbor, was the lower end of the river. As the lake began to level to its present height, waves and currents created sandbars and ridges which have resulted in the present location of the mouth of the river at Port Clinton.

The watershed developed into a vast swamp region which was the last part of Ohio to be cleared and settled. The name "Black Swamp" was given to this country which extended nearly 120 miles in length and averaged 40 miles in breadth.

The removal of the forests of the Black Swamp and the establishment of a network of ditches changed the watershed. Waters which once were clear now carried big loads of sediments, thus causing the stream to be muddy, especially during freshets.

The Portage River is characterized by a natural division into three zones: (1) low gradient upstream area, with a network of drainage ditches, pool bottoms of silt, sand, and clay; (2) a central area of riffles and pools, pool bottoms of limestone; (3) an extensive ponded lower area with slow flowage discharging into Lake Erie, which lake has a great influence upon the river.

Fishes of the river number 69 different species. There are three different groups in the three zones of the stream. The upstream area has pond minnows and mud-pickerel, trout-perch, and green sunfish. The mid-stream area has smallmouth bass, rock-bass, suckers, and darters. The lower area has largemouth bass, white crappies, bluegills, yellow perch, catfish, bullheads, shad, and carp.

Management of the watershed has been chiefly concerned with efforts to carry away the water. Ditch banks are kept clean of woody plants, lack sod cover, and are subject to erosion. Most of the land is under cultivation, heavily fertilized, and tiled for drainage. The fishes are directly affected by heavy fertilization of the watershed, which is not needed for fish production. Habitat improvement aimed at changing ditches to streams is not compatible with the culture of the region. Constant, even waterflow, especially through the mid-section of the stream, would directly improve the fishery. Pollution abatement, constant flow, and reduced fertilization would improve the habitat and create a more favorable fishery, especially for the more desirable game species. (Author)

7775. Ryan, P. (Dept. of Fisheries of Canada, Vancouver, B. C.). 1965. A DEVICE FOR INJECTING JUVENILE FISH INTO A PRESSURE CONDUIT. The Canadian Fish Culturist, Issue 34, pp. 27-29.

An apparatus for safely injecting live fish into a high pressure water conduit without allowing the fish access to a free air surface while under increased pressure is described. (Author)

7776. Dechtiar, Alex O. (Ontario Dept. of Lands and Forests, Maple, Ontario). 1965. A NEW DISTRIBUTION RECORD FOR MYXOSOMA SCLEROPERCA GUILFORD, 1963 (SPOROZOA; MYXOSOMATIDAE) IN YELLOW PERCH OF LAKE ERIE. The Canadian Fish Culturist, Issue 34, pp. 31-34.

7777. Dechtiar, Alex O. (Ontario Dept. of Lands and Forests, Maple, Ontario). 1965. PRELIMINARY OBSERVATIONS ON GLUGEA HERTWIGI, WEISSENBURG, 1911 (MICROSPORIDIA; GLUGEIDAE) IN AMERICAN SMELT, OSMERUS MORDAX (MITCHILL) FROM LAKE ERIE. The Canadian Fish Culturist, Issue 34, pp. 35-38.

7778. Madgwick, J. C. 1965. QUANTITATIVE CHROMATOGRAPHY OF ALGAL CHLOROPHYLLS ON THIN LAYERS OF GLUCOSE. Deep-Sea Res., 12(2): 233-236.

Chlorophylls were separated by thin layer chromatography using glucose as an adsorbent. The developing solvent was 0.8% n-propanol in petroleum spirit. The best eluant was 90% acetone. Microcells were used for spectrophotometric measurements. Chlorophyll a (0.48-5.30 µg) was recovered with a mean loss of 9%, b (0.5-2.48 µg), 17%, and c (0.70-1.45 µg), 12%. (Author)

7779. Yamamoto, Kiichiro, Isao Oota, Kazunori Takano, and Tetsuji Ishikawa (Faculty of Fisheries, Hokkaido Univ., Hakodate, Japan). 1965. STUDIES ON THE MATURING PROCESS OF THE RAINBOW TROUT, SALMO GAIRDNERII IRIDEUS—I. MATURATION OF THE OVARY OF A ONE-YEAR OLD FISH. Bulletin of the Japanese Society of Scientific Fisheries, 31(2): 123-132.

The one-year fish seasonally holds the ovaries which contain the egg-cells of the various stages of development from the oogonia to the ripened eggs. The course of the development of the egg-cells was described as occurring in eight stages.

The ovarian eggs show the development of the partial synchronism and the maturing ovaries contain two groups of oocytes, which are clearly distinguishable from each other in their development. The ovarian maturity of this species may be adequately represented by the stage of the more advanced oocytes. Maturity indices of this organism increase conspicuously after the ovaries have arrived at the primary yolk stage.

Based on the maturity factor, the distinction between the maturing fish and immature ones becomes clear by July or August. Thereafter, no fish which had an intermediate ovary ranging between the maturing and immature groups was found. In August the maturing group of fish has ovaries mostly in the primary yolk stage but sometimes that occur in the fatty drop stage, while the immature group yields ovaries that are younger than the yolk vesicle stage.

The maturing group of fish shows a much larger growth rate than the immature group, so that the difference between the body weight of the two groups becomes more distinct with the passing of time. As it comes near the spawning season, however, the growth rate of the maturing group decreases markedly and the fish tend to show a shrinkage in weight and even in size. (Authors)

7780. Chrystie, Einar L. (New York Conservation Dept., Albany). 1965. EXPERIMENT IN FUN. The Conservationist, 19(6): pp. 2-4.

A 2.8-mile reach of Amawalk Outlet, located some 35 miles from midtown Manhattan became a fish-for-fun stream in 1963. End of season trout population counts showed 4,667 fish (1,218 over 6 inches) in 1962 and 10,741 (4,899 over 6 inches) in 1964. There is adequate reproduction of brown trout in lower two-thirds of the reach and it is hoped that the section above a dividing falls will soon be adequately stocked from a brown trout population.

7781. Greeley, John R. (New York Conservation Dept., Albany). 1965. NEW RESEARCH CENTER AT CAPE VINCENT. The Conservationist, 19(6): 12-14.

The Cape Vincent Fish Hatchery of the Bureau of Sport Fisheries and Wildlife was recently leased to the New York State Conservation Department for a 10-year period to be operated by the State as a biological research center. Cooperation between this laboratory and the biological research station at Picton of the Ontario Department of Lands and Forests, will facilitate the aim of the two conservation agencies to manage Lake Ontario for sustained recreational fishing and such commercial fishing as may prove feasible.

7782. Webster, Dwight A. (Cornell Univ., Ithaca, New York). 1965. LEAPING RAINBOWS OF THE FINGER LAKES. The Conservationist, New York State Conservation Dept., 10(3): 10-13.

An investigation of the upstream migration of rainbow trout and the factors which aid and hinder it. Water temperatures significantly effect the pattern of migration.

7783. Raney, Edward C. (Dept. of Conservation, Cornell Univ., Ithaca, New York). 1965. SOME PAN FISHES OF NEW YORK— YELLOW PERCH, WHITE PERCH, WHITE BASS, FRESHWATER DRUM. The Conservationist, New York State Conservation Dept., 10(3): 22-28.

An account of the range, importance, and life history of these four species.

7784. Albrecht, Marie-Luise (Aus dem Institut für Binnenfischerei der Deutschen Akademie der Landwirtschaftswissenschaften zu Berlin, Abteilung für Teichwirtschaft und Fischkrankheiten, Berlin-Friedrichshagen). 1964. DER EINFLUB VON LICHT UND TEMPERATUR AUF DIE SAUERSTOFFPRODUKTION IM WASSER UNTER EIS UND SCHNEE. Zeitschrift für Fischerei, Band XII N. F., Heft 3/4/5, pp. 167-182.

Even during the deepest position of sun the light intensity and exposure time are not too low to many species of algae. However, a remarkable regress in plankton production occurs but also often a mass development of oligothermic species takes place.

The light permeability of clear ice is essentially greater than that of water. The spectral composition of light is virtually unchanged after passing the ice while the water mainly absorbs the ultra-violet and violet rays. Thus snow upon ice forms a layer impermeable to light. Sufficient light for photosynthesis may only penetrate snow up to 2 cm.

Assimilation of diatomean at very low water temperatures (0.2 to - 2° C.) is considerably reduced but not yet suspended. At 0 - 0.6 ° C. in water containing only a small number of plankton a significant oxygen increase was noted. The results of the tests conducted in tanks have been confirmed by investigations in the pelagial and by observations of the oxygen conditions in the Muggelsee in winter 1963.

Studies in water and bottom samples from 20 ponds showed that even after a 10-week snow cover a great number of algae survives at the bottom of the pond where they assimilate as soon as light breaks in. Mostly the water of the pond is free of plant organisms. The influence of fouling algae and of specimens of phytoplankton at the bottom upon the O_2-production is shown in an experiment. (Auth. Summ.)

7785. Anwand, Karl (Institut für Binnenfischerei der Deutschen Akademie der Landwirtschaftswissenschaften zu Berlin, Abteilung für Seen- und Flußfischerei). 1964. ZUR FRAGE DES ZWECKMÄBIGSTEN SATZZANDERTRANSPORTES. Zeitschrift für Fischerei, Band XII N. F., Heft 3/4/5, pp. 183-198.

Pike-perch fingerlings (Lucioperca lucioperca) often die in transit and during retention in tanks. For that reason in autumn 1963 the author started an investigation on the water quality and observed the fish in transit and during retention. When transporting pike-perch fingerlings, the main losses are caused by mechanical injuries as there are too dense stocking in tanks, improper treatment, and bad condition of fish. Damages by a too high oxygen content of water could not be demonstrated but were possible.

When transporting pike-perch fingerlings longer than 10 hours it is commendable to take only 3 - 4 pike-perch/l water and to vent with compressed air instead of oxygen. The oxygen content of water should lie above 4.5 - 5 mg/l, supersaturation should be avoided. (Auth. Summ.)

7786. Lieder, Ulrich (Institut für Fischereiwesen der Humboldt-Universität zu Berlin). 1964. POLYPLOIDISIERUNGSVERSUCHE BEI FISCHEN MITTELS TEMPERATURSCHOCK UND COLCHIZIN-BEHANDLUNG. Zeitschrift fur Fischerei, Band XII, N. F., Heft 3/4/5, pp. 247-256.

To multiply chromosome sets (polyploidization) in fish (as in animals generally) is very difficult on technical but also on principal reasons. The fairest chance of success may have shocks by cold on spawned eggs before the reduction division. By this method Svarup (18) succeeded for the first time in producing triploidy in sticklebacks. Treatment of embryos with colchicine is technically more difficult and besides the stability of the obtained polyploids is impared by supernumary centrosomes provoking deregulations after the colchicine influence has ended (according to the Book hypothesis). The main task of the experimental polyploidization is, as the authors mentions, the problem of making sterile hybrids, as for instance carp x crucian carp, fertile by polyploidy. Here the selective breeding gets a new field for study. (Auth. Summ.)

7787. Steffens, Werner (Institut für Binnenfischerei der Deutschen Akademie der Landwirtschaftswissenschaften zu Berlin, Abteilung für Teichwirtschaft und Fischkrankheiten, Berlin-Friedrichshagen). 1964. DIE WEIBFLECKENKRANKHEIT DER SALMONIDENBRUT. Zeitschrift fur Fischerei, Band XII, N. F., Heft 3/4/5, pp. 405-409.

For several decades the white-spot disease is known from American trout and salmon hatcheries. Some years ago for the first time two cases of white-spot disease have been recorded in trout pond farms of the GDR. Mostly soon after hatching the fry falls ill, however, diseases of eggs have been described too. External indices are small white spots in the yolk sac consisting of coagulated protein and being symptoms of an all-round disorder in metabolism. Histologically severe liver lesions can be demonstrated. In the course of the disease the losses are often numerous. It is suggested that unfavorable physico-chemical influences, still unknown up to now, may cause the white-spot disease. Hitherto a sufficient oxygen supply of eggs and fry can be recommended as only control against this disease.

7788. Schäperclaus, Von W., and M. Brauer (Institut für Binnenfischerei der Deutschen Akademie der Landwirtschaftswissenschaften zu Berlin, Abteilung für Teichwirtschaft und Fischkrankheiten, Berlin-Friedrichshagen). 1964. BEDEUTUNG DER FLUORESZENTEN FÜR DIE ENTSTEHUNG UND BEKÄMPFUNG DER INFEKTIÖSEN BAUCHWASSERSUCHT DER KARPFEN. Zeitschrift für Fischerei, Band XII N. F., Heft 1/2, pp. 75-96.

To determine fluorescent organisms in fish a new method was developed. By this method it was made evident that in some cases fluorescent organisms are obviously associated with the origin of infectious dropsy. Highly pathogenic strains of Pseudomonas fluorescens do occur but apparently not in abundance.

Since chloramphenicol does not remove fluorescent organisms, it is necessary, if they occur in great lots, to apply other antibiotics such as streptomycin, tetracycline, chlortetracycline and oxytetracycline. When using streptomycin in field tests the losses were less than when using chloramphenicol. Nevertheless it is commendable to use streptomycin and other antibiotics only if the occurrence of fluorescent organisms was demonstrated or is at least probably. Chloramphenicol has so many advantages in controlling dropsy that without cogent reason its application should not be omitted. In special cases the simultaneous application of streptomycin and chloramphenicol or another combination of antibiotics is advantageous. (Auth. Summ.)

7789. Mattheis, Theobald (Institut für Binnenfischerei der Deutschen Akademie der Landwirtschaftswissenschaften zu Berlin, Abteilung für Teichwirtschaft und Fischkrankheiten, Berlin-Friedrichshagen). 1964. ÖKOLOGIE DER BAKTERIEN IM DARM VON SÜBWASSERNUTZFISCHEN III. FAMILIE ENTEROBACTERIACEAE, GATTUNG ESCHERICHIA, AEROBACTER, PARACOLOBACTRUM, PROTEUS. Zeitschrift für Fischerei, Band XII N. F., Heft 8/9/10, pp. 561-600.

From the intestines of 24 rainbow trout (Salmo gairdneri), 13 carp (Cyprinus carpio), and 7 brown trout (Salmo trutta) 219 bacteria strains have been isolated. By morphological, cultural, and physiological characteristics it was possible to identify 204 of them as belonging to 32 species, 10 genera, and 5 families. Fifteen strains (7.4%) could not be determined by the methods applied.

The investigations showed that in rainbow trout from hatcheries the influence of intensive feeding can be observed by the composition of the enteric flora. The intestines of brown trout from natural waters which served as control fish contained a relatively small number of different bacteria species; only 6 species could be made evident compared with 28 species in the intestines of rainbow trout from hatcheries with intensive feeding.

In the intestines of the examined carps genuine water bacteria (Pseudomonas, Aeromonas) were dominant. Besides there were species knows for their ability to propagate in water under favorable conditions though to be foreign organisms as to their origin.

After 4-1/2 months of fasting the intestines of rainbow trout had not been entirely free of bacteria. However a reduction of species and number could be observed which ran parallel to the nearly complete disappearance of strains with protein decompositive properties. There are different opinions in literature about the problem whether after longer fasting the fish intestine is free of bacteria.

The most abundant species of bacteria which had been isolated were the fish pathogens Pseudomonas fluorescens and Aeromonas punctata, the cause of infectious dropsy in carp. As potential morbific agents they are widely distributed both in the intestines of the examined fish and in water. (Auth. Summ.)

7790. Jančařík, Ant. (Aus dem zootechnischen Institut in Uhříněves bei Prag, Abteilung für Physiologie der Nutztiere). 1964. DIE VERDAUUNG DER HAUPTNÄHRSTOFFE BEIM KARPFEN. Zeitschrift für Fischerei, Band XII, N. F., Heft 8/9/10, pp. 601-684.

This paper contains an overall survey of the results of the study of the digestion of starch (chapter IV), of fat (V), and of animal (VI) and vegetable (VII) proteins. These results are partly new ones, and partly already earlier published but recently checked and corrected results. Chapters IV and V deal with the determination of the digestive effectiveness of the bile of carp (A), with the intestinal contents (B), with the extract of the pancreas and of the liver of carp (C), with the extract of the intestinal mucous membrane (D), (i.e. with the endogenous substances in carp), and further with the main components of carp food (i.e. with the exogenous substances), i.e. daphniae (E), tubifids (F), earthworms (G), and larvae and chrysales of mosquitoes (H). Further, the digestive effectiveness of mixed endogenous and exogenous substances was investigated. In this paper the results obtained have been elaborated in the form of tables and diagrams.

It was found that starch is digested in the digestive tract of carp both by endogenous (B, C, D) and exogenous (E, F. G, H) substances. The amylolytic effect of the extract from the intestinal mucous membrane of carp was proved. It was also proved that the digesting of starch in the intestinal cavity progresses as a multi-phase process. Exogenous substances fissure starch in the pH 4.0 - 8.0 zone. The effect of exogenous amylases may become apparent also in the intestines of carp, and particularly so in the case of a diminished effectiveness of the endogenous amylases of carp. A perfect digestion of starch in carp can be ensured only by a sufficient supply of animal food. Because of the enormously high effectiveness of the endogenous amylases animal foods can conslusively cause their decrease.

Further, the lipolytic effects of endogenous (A, B, C, D) and exogenous (E, F, G, H) substances were ascertained. In the intestines of carp fat is digested simultaneously also by the pancreatic and by the biliary lipase. An addition of bile to the endogenous or exogenous substances increases their lipolytic effect, wherein also their emulgent effect plays its part. The addition of an extract form of compounds of the animal foods of carp (E, F, G, H) to an endog-

enous substance (B, C, D) causes a rising of the lipolytic effectiveness, which, however, never exceeds the sum of both partial effectivenesses. An excessively high endogenous lipolytic effectiveness in carp is lowered by animal foods (particularly by an extract from the larvae and chrysales of gnats).

Also the proteolytic effect of endogneous (A, B, C, D) and exogenous (E, F, G, H) substances in carp on animal and vegetable proteins was investigated. The activation of the proteolytic effect of a pancreatic extract from carp by an extract from the intestinal mucous membrane was confirmed, if the substratum was an animal protein. A much higher activating effect was achieved with an addition of the intestinal contents. Later it was proved that the exogenous (E, F, G, H) substances exert an activating effect on the endogenous proteases of carp. A hypothesis illuminating the activating effect was discussed.

In the investigation of the digestion of vegetable proteins that had been isolated from beans (Bo), peas (Er), ground-nuts (En) and from soya beans, it was found that after the addition of exogenous substances (E, F) to the endogenous substances of carp (B, C, D) an increase of the proteolytic effectiveness set in, but no activating effect was proved. Casein, as a comparative animal protein, was in all cases digested more intensively than the tested vegetable proteins. The fact was confirmed that the proteolytic effectiveness of animal foods is the stronger the lower the effectiveness of the endogenous proteases of carp.

In the conclusion the author points out the function of natural food of carp as a factor regulating to a great extent, the digestion of carp. From this a new conception regarding the biological balance in carp ponds emerges. This new conception provides pre-conditions for measures leading to an increased production of carp, as has been proved by means of comparative tests. (Auth. Summ.)

7791. Maxwell, John M. and Robert W. Thoesen (Bureau of Sport Fisheries and Wildlife, Albuquerque, New Mexico). 1965. LAKE POWELL STOCKING STORY. The Progressive Fish-Culturist, 27(3): 115-120.

In 1963 a fleet of Federal and State trucks was used to haul more than 3 million rainbow trout and nearly 1 million largemouth bass from various hatcheries to a newly impounded lake. Extensive use of airplane transportation in 1964 permitted stocking of the same lake with 4 million rainbow trout and 2 million largemouth bass in superior condition and at a saving of money and man-hours.

7792. Ruth, D. J. and M. A. E. Mortimer (Game and Fisheries Dept., Northern Rhodesia, Zambia). 1965. THE TRANSPORT OF LIVE FISH IN NORTHERN RHODESIA. The Progressive Fish-Culturist, 27 (3): 121-128.

Three simple methods for the transport of live cichlid fish under subtropical conditions in an underdeveloped country are described. Small numbers are transported in cans, large numbers in a tanker, and special consignments in polythene bags. The simplest practical aids to survival of live fish are cleanliness and cold water. (Authors)

7793. Snieszko, S. F. (Bureau of Sport Fisheries and Wildlife, Kearneysville, West Virginia). 1965. SURVEY, REPORTING, AND CERTIFICATION OF DISEASES IN FISH PRODUCTION. The Progressive Fish-Culturist, 27(3): 129-133.

Control of communicable and other fish diseases lags behind the control diseases of humans, domestic animals, and agricultural plants. This lag is due largely to inadequate development of the epizootiology of fish diseases, failure to report and analyze the pattern of outbreaks, and lack of certification of breeding stocks for freedom from infection with germs of communicable diseases. Discussed are measures which should be taken to place the control of fish diseases on the same level with control of diseases of farm-raised mammals and birds. (Author)

7794. Combs, Bobby D. (Bureau of Sport Fisheries and Wildlife, Salmon-Cultural Lab., Longview, Washington). 1965. EFFECT OF TEMPERATURE ON DEVELOPMENT OF SALMON EGGS. The Progressive Fish-Culturist, 27(3): 134-137.

By using constant incubating temperatures, the lower threshold temperature for the normal development of sockeye salmon (Oncorhynchus nerka) eggs was established at between 40° and 42.5° F., and the upper threshold temperature at between 55° and 57.5° F. Chinook salmon (O. tshawytscha) eggs which had developed to the 128-cell stage could tolerate 35° F. water for the remainder of the incubation period. Although sockeye eggs attained the 128-cell stage in 72 hours at 42.5° F., a slight additional development into the stage of unequal cell division was necessary before they could endure 35° F. water for the remainder of the incubation period. (Auth.)

7795. Rock, Leo F., and Harold M. Nelson (Illinois Dept. of Conservation, Springfield). 1965. CHANNEL CATFISH AND GIZZARD SHAD MORTALITY CAUSED BY AEROMONAS LIQUEFACIENS. The Progressive Fish-Culturist, 27(3): 138-141.

Aeromonas liquefaciens cuased heavy mortalities of channel catfish (Ictalurus punctatus) and gizzard shad (Dorosoma cepedianum) in the Rock River in northern Illinois in 1961. The channel catfish mortality occurred late in August throughout a 30-mile section of the river; mortality was heaviest among young-of-the-year and two-year-olds. A massive kill of gizzard shad immediately followed the channel catfish kill. The channel catfish carcasses, affording reservoirs for A. liquefaciens, were probably instrumental in the transfer of the disease to the gizzard shad populations. The channel catfish exhibited marked external evidence of infection: skin and muscle necrosis, exophthalmus, and often total blindness. Few gizzard shad showed external evidence of infection except for minor hemorrhagic areas in the axils of the pectoral fins. The disease outbreak was thought to have been closely associated with poor environmental conditions (low water and high accumulations of organic wastes), which probably

stimulated the density of the Aeromonas populations and contributed to fish debility. (Authors)

7796. Holmes, Perry D., and James W. Mullan (University of Arkansas, Fayetteville). 1965. INFECTION INCIDENCE AND INTENSITY OF BASS TAPEWORM IN BLACK BASSES OF BULL SHOALS RESERVOIR. The Progressive Fish-Culturist, 27(3): 142-146.

Conditions of infection with bass tapeworm (Proteocephalus ambloplitis) plerocercoids of basses from an Ozark impoundment are described, and comparisons drawn between this water and lacustrine waters of northeastern United States. The infection incidence of reservoir smallmouth, spotted, and largemouth bass (88 to 100%) was notably higher than river fish of the same species (21 to 57%), but similar to that reported for smallmouth and largemouth basses from Connecticut (70 to 100%) and Massachusetts (91 to 95%), and for smallmouth bass from New Hampshire (80%). The infection intensities, with some variations indicated the same relationship. (Authors)

7797. Linn, D. Wayne (Dakota Wesleyan University, Mitchell, South Dakota). 1965. TAKE A ONE-GALLON JAR— . The Progressive Fish-Culturist, 27(3): 147-152.

Unfed goldfish were retained for 5, 10, and 15 days in 1-gallon jars containing static but aerated water at temperatures of 50°, 60°, or 70° F. After the predetermined exposure of time and temperature, a water sample was removed and analyzed for pH, carbon dioxide, dissolved oxygen, and total nitrogen. The major changes were an increase in nitrogen and a decrease in oxygen with an increase in temperature and time. The blood of decaudated goldfish was extracted for an analysis of its microhematocrit, total plasma proteins, and white blood cell count. The major changes were a decrease in microhematocrits and total plasma proteins with an increase in temperature and time. The white blood cell counts suggested similar trends, but these were not statistically confirmed. (Auth)

7798. Pickering, Quentin H., and William N. Vigor (Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio). 1965. THE ACUTE TOXICITY OF ZINC TO EGGS AND FRY OF THE FATHEAD MINNOW. The Progressive Fish-Culturist, 27(3): 153-157.

Acute toxicity bioassays were conducted with zinc under continuous-flow conditions to determine the comparative toxicity to fathead minnow (Pimephales promelas) eggs and fry. The eggs were less than 1 day old at the beginning of exposure to zinc. Twelve-day median tolerance limits (TL_m) of these eggs ranged from 1.55 to 1.78 mg/l of zinc. Survival in the test concentrations of 1.06 and 1.05 mg/l or less of zinc was not different from survival in the control. One-day-old fry were more sensitive than the eggs. (Authors)

7799. Tate, Bill, Tom Moen, and B.I. Severson (State Conservation Commission, Des Moines, Iowa). 1965. THE USE OF ROTENONE FOR RECOVERY OF LIVE FISH. The Progressive Fish-Culturist, 27(3): 158-160.

A lethal dose of rotenone is applied near the propeller of a running outboard motor that is mounted on a bracket anchored in the pond bottom. The rotenone is diluted so that a concentration of 1/2 ppm is reached in one-half hour. As the fish are affected by the rotenone, they move toward the shore, where they are easily retrieved with dip nets. About 77% of the largemouth bass fingerlings were recovered by this technique. The survival rate of 6,685 largemouth bass fingerlings recovered by this technique was 80.7%. (Authors)

7800. Bouck, Gerald R., and Robert C. Ball (Dept. of Fisheries & Wildlife, Michigan State Univ., East Lansing). 1965. THE USE OF METHYLENE BLUE TO REVIVE WARM-WATER FISH POISONED BY ROTENONE. The Progressive Fish-Culturist, 27(3): 161-162.

On three separate occasions emergency treatment with methylene blue was successful in reviving fish poisoned with rotenone. In an experiment to determine the optimum concentration for use in a 3-hour treatment, rainbow trout were not revived, but rock bass survived at a concentration of 5 ppm methylene blue. (Authors)

7801. Bullock, Graham L. (Bureau of Sport Fisheries and Wildlife, Kearneysville, West Virginia). 1965. SIMPLE ENRICHMENT OF COMMERCIAL MEDIA FOR GROWTH OF HEMOPHILUS PISCIUM. The Progressive Fish-Culturist, 27(3): 163-164.

Out of 10 tested, 2 commercial media enriched with cocarboxylase proved to be satisfactory substitutes for Leetown No. 8. (Auth.)

7802. Anonymous. 1965. A TROUT FROM YUGOSLAVIA. The Progressive Fish-Culturist, 27(3): 164.

Eyed eggs of the Ohrid trout (Salmo letnica), air-shipped by the Yugoslavian Government in exchange for rainbow trout eggs, have been hatched at two fish hatcheries of the Bureau of Sport Fisheries and Wildlife. Some of the young have been stocked on an experimental basis in two carefully selected lakes; the remainder are being held for use as brood fish if the trout is successful in these waters.

7803. Taube, Clarence M. (Institute for Fisheries Research, University Museums Annex, Ann Arbor, Michigan). 1965. THE USE OF PARAFORMALDEHYDE AS A BIOLOGICAL PRESERVATIVE. The Progressive Fish-Culturist, 27(3): 165-168.

Paraformaldehyde can be used to make formaldehyde solution (formalin) when a catalyst is employed to increase its solvency. In some situations the solid form and lesser bulk of the polymer give it definite advantages over concentrated aqueous formaldehyde. A pint of 20-percent formalin can be prepared within a minute in boiling water with 37 g of 95-percent paraformaldehyde and 5 grains of solid KOH or NaOH, or 4 g of sodium tetraborate

(borax) crystals. Potassium hydroxide and NaOH are effective also in cool water. At 70° F., 2 g of either base will provide a pint of 20-percent solution in 30 minutes. Ten-percent concentrations of these solutions preserved fish well, and probably are suitable for other organisms, too. (Auth.)

7804. Bailey, Merryll M. (Bureau of Commercial Fisheries, Ashland, Wisconsin). 1965. LAKE TROUT FIN-CLIPPING RATES AT TWO NATIONAL FISH HATCHERIES. The Progressive Fish-Culturist, 27(3): 169-170.

The successful stocking of hatchery-reared lake trout (Salvelinus namaycush) in Lake Superior has improved greatly the outlook for rehabilitation of stocks reduced to an extremely low level by the sea lamprey (Petromyzon marinus). Data on marking rates were collected in 1958-63 at two national hatcheries where more than 3.5 million lake trout were fin-clipped. The average number of fish marked per worker per hour was 549 for removal of one fin and 453 for two fins. Hourly fin-clipping rates for single fins was considerably greater for pectoral fins (629) than for pelvic fins (441). Comparisons for various combinations of double marks showed no consistent differences. The effect of size at the time of marking was studied in a group of yearlings divided into two lots according to size and marked under similar conditions. Post-clipping mortality was 1.50% among 210,000 smaller fish (average length, 4.3 inches) and 0.15% among 134,000 larger fish (average length, 5.3 inches). (Auth.)

7805. Klein, W. D. (Dept. of Game, Fish and Parks, Fisheries Research Center, Ft. Collins, Colorado). 1965. MORTALITY OF RAINBOW TROUT CAUGHT ON SINGLE AND TREBLE HOOKS AND RELEASED. The Progressive Fish-Culturist, 27(3): 171-172.

Spinning and fly rods and a daredevil-type lure were used to catch rainbow trout from a rearing pond. Half of the trout were caught with a treble hook on the lure, and half with a single hook. Mortalities were significantly greater for trout caught with a single hook. (Auth.)

7806. Joeris, Leonard S. (Bureau of Commercial Fisheries Biological Laboratory, Ann Arbor, Mich.). 1965. AUTOMATIC FEEDER FOR SMALL FISH HELD IN TANKS. The Progressive Fish-Culturist, 27(3): 173-174.

Details of construction are given for an automatic feeder that dispenses commercially produced pellets into a hatchery tank. An electric timer controls the intervals at which food is released from the food reservoir (a Mason jar); the diameter of an opening in a slide mechanism actuated by a solenoid determines the quantity of food dispensed. The device facilitates the continuous feeding of small fish with minimal attention from the fish-culturist. (Auth.)

7807. Hoffman, G. L., G. W. Prescott, and C. R. Thompson (Bureau of Sport Fisheries and Wildlife, Kearneysville, West Virginia). 1965. CHLORELLA PARASITIC IN BLUEGILLS. The Progressive Fish-Culturist, 27(3): 175.

Nine dark green cysts containing algae were found in the eye orbit of one bluegill (Lepomis macrochirus). The cysts were filled predominantly with a green unicellular alga, Chlorella sp., and a lesser amount of a blue-green alga, apparently Phormidium mucicola. The host cyst was composed of three distinct layers of connective tissue, the outer two being loose and the inner one very compact. (Auth.)

7808. Murphy, Maud Alice (Bureau of Commercial Fisheries, Galveston, Texas). 1965. A MICRO-COUNTING CHAMBER. The Progressive Fish-Culturist, 27(3): 176.

A small pipette has been devised to expedite counts of microorganisms in laboratory cultures or in samples of phytoplankton from the field.

7809. Kevern, N. R., and R. C. Ball (Dept. of Fisheries and Wildlife, Michigan State University, East Lansing). 1965. PRIMARY PRODUCTIVITY AND ENERGY RELATIONSHIPS IN ARTIFICIAL STREAMS. Limnology and Oceanography, 10(1): 74-87.

The productivity of algal communities was investigated in two recirculating artificial streams. Emphasis was placed on a study of the effects of various factors on energy flow and on the characterization of artificial streams as a research tool. Productivity was measured by pH and carbon dioxide changes, upstream-downstream oxygen changes, and the biomass of algae collected on artificial substrata.

A temperature increase caused a small, but insignificant, increase in net productivity, while increased light intensity caused an increase in net productivity. A higher current velocity caused an increase in net productivity, significant as shown by riffle vs. pool communities, but not significant between a fast and a slow stream. A shorter, but more frequent photoperiod did not change the rate of production significantly. High chelate concentration caused a reduction in net productivity.

Estimates of net productivity by the carbon dioxide and oxygen methods were in agreement for two out of five studies, while estimates by the biomass of algae on substrata were consistently lower than estimates by the gas methods. Net production varied from 2,815 to 5,565 cal m^{-2} day^{-1}, resulting in efficiencies from 3.8 to 9.8%. Efficiencies of gross productivity varied from 6.4 to 16.1%. (Authors)

7810. McFadden, James T., Edwin L. Cooper, and John K. Andersen (Institute of Fisheries, University of British Columbia, Vancouver). 1965. SOME EFFECTS OF ENVIRONMENT ON EGG PRODUCTION IN BROWN TROUT (SALMO TRUTTA). 1965. Limnology and Oceanography, 10(1): 88-95.

Brown trout collected from fertile and infertile streams in Pennsylvania were compared to determine differences in fecundity and in the age at first sexual maturity. Trout from infertile streams were older at first sexual maturity and produced fewer eggs because of smaller average size than trout from fertile streams. Fish of the same size produced a smaller

total weight of eggs in infertile waters than in fertile waters. Sexual maturation depended on both size and age. It was concluded that in waters of low basic productivity few eggs are produced per adult trout in the stock and that this depressed rate of reproduction is important in keeping brown trout populations in equilibrium with the low basic productivity of the environment. (Authors)

7811. Carpenter, James H. (Dept. of Oceanography, The Johns Hopkins University, Baltimore, Maryland). 1965. THE ACCURACY OF THE WINKLER METHOD FOR DISSOLVED OXYGEN ANALYSIS. Limnology and Oceanography, 10(1): 135-140.

The potential errors in the various techniques for the Winkler method have been examined and a new technique developed. The accuracy of this technique has been tested by comparison with standards based on dissolving known quantities of oxygen in oxygen-free water. An accuracy of 0.1% was observed, so the technique appears suitable for oxygen analyses requiring an accuracy of greater than the 3-5% observed with the common techniques. (Auth.)

7812. Whitaker, Robert B. 1965. NEW HOPE FOR THE GILA. Field and Stream, 70(4): 48, 49, 62, 64, 65.

Cooperative efforts by the Bureau of Sport Fisheries and Wildlife, the Arizona Game and Fish Department and the White Mountain Apaches are expected to preserve the remnant stock of pure Gila trout in Arizona. This recently classified species is also resident in the headwater streams on the Apache and Gila National Forests of New Mixico and is being propagated at the State hatchery at Glenwood.

7813. Anonymous. 1964. INLAND FISHERIES COMMISSION REPORT FOR YEAR ENDING 30th JUNE, 1964, Hobart, Tasmania, Australia, 24 p.

One hundred years after the introduction of brown trout into Tasmania, the original hatchery was converted to a fish hatchery museum. The artificial propagation of brown trout in Tasmania is now carried out on a small scale to stock certain lakes and farm ponds where natural spawning facilities are not available. Report covers problems and progress on administration, management, investigations, and revenue of the commission during the year.

7814. Tesch, F. W. (Aus dem Niedersachsischen Landesverwaltungsamt, Binnenfischerei, Hannover). 1964. ECHOGRAPHENAUFZEICHNUNGEN IN FISCHPASSEN ZUR UNTERSUCHUNG DER WANDERUNGSAKTIVITAT VON FISCHEN. Archiv für Fischereiwissenschaft, 15(3): 186-193.

At the fish-pass of the river Elbe near Geesthacht above Hamburg, controls of ascending fishes have been made by means of the Elac-Echograph Superior. Comparisons for explaining the records were made possible by control catches in baskets and by the use of an echo-sounder in an experimental basin.

Conclusions could be made concerning number, species, and behaviour of the passing fishes. The method is particularly advantageous when differences of the various day-times and the effect of various factors, within brief intervals, on the migration of fishes are to be investigated. The control is also possible for fishes of smaller sizes. (Auth. Summ.)

7815. Starrett, William C., and Arnold W. Fritz (Illinois Natural History Survey, Urbana, Illinois). 1965. A BIOLOGICAL INVESTIGATION OF THE FISHES OF LAKE CHAUTAUQUA, ILLINOIS. Illinois Natural History Survey Bulletin, Volume 29, Article 1, 104 p.

Lake Chautauqua is a restored 3,562-acre lateral-levee reservoir, shallow and subject to flooding by the Illinois River.

Prior to 1951, fishing pressure on the lake was comparatively light. Up to that year, commercial fishing was restricted to the use of individual wing nets. The estimated annual yield from the lake (all fishes) in the period 1942-1949 ranged from 12 to 45 pounds per acre (48.4 pounds per acre in 1950). To increase the yield, supervised commercial seining was carried on at the lake in September of each year, 1951-1958. Roundup fishing with wing nets, started at the lake in 1952, helped to increase the yield. In the 1951-1958 period, the annual yield of all fishes ranged from 73.1 to 121.0 pounds per acre. During the 10-year period of the study, 2,991,131 pounds or 839.7 pounds per acre were removed. Buffalofishes (mainly bigmouth buffalo) comprised 49.1 percent of the weight of fishes removed from the lake.

Sixty-four species of fish were collected from the lake, but only 13 species occurred abundantly. The abundant species were bigmouth buffalo, gizzard shad, carp, freshwater drum, bluegill, white crappie, black crappie, yellow bass, channel catfish, shortnose gar, emerald shiner, spottail shiner, and brook silverside.

During the investigation, only two dominant year-classes of adult bigmouth buffalo were observed, those of 1948 and 1953. The increased removal of bigmouth buffalo changed the buffalo population in 4 years from one containing a high percentage of old, large fish to one of predominantly young, small fish.

Only two year-classes of white bass observed in the lake during the study were of even moderate size. Tagging studies indicated that a large percentage of white bass over 1 year old moved out of the lake in periods of high water.

The standing crop of all species of fish at Lake Chautauqua was estimated to be about 500 pounds per acre in the 1951-1952 period. In 1957, the estimated standing crop of usable-size fish of four commercial kinds and gizzard shad was not far below the 1951-1952 estimate for these species. However, the species composition had changed. Populations of shad and of undersized carp had increased in size since the earlier period.

The population of freshwater drum showed a downward trend after 1954. This trend was apparently associated with increased removal of drum and the scarcity of members of two year-classes.

The catch of gizzard shad per estimated acre seined in the 1951-1952 period was 19.7 pounds, whereas in 1957 the catch was 88.5 pounds per acre seined. Increases in the shad population appeared to be associated with decreases in the bigmouth buffalo population.

At the end of 4 or 5 years of the investigation, improvements in growth and condition of bluegills, crappies, freshwater drum, and bigmouth buffalo could have been correlated with the increased removal of commercial fishes. When the investigation was continued, the early improvements apparently were lost. Successful reproduction, recruitment of fish from the river, and water levels tended to offset any measureable benefits resulting from the increased removal of fish.

In the past 35 years, siltation has greatly changed the ecology of many of the floodplain lakes of the Illinois River. For management of the fishery, sedimentation surveys of Lake Chautauqua should be made every 10 years and the summer pool stage of the lake increased to compensate for any loss of storage capacity caused by siltation.

The density-independent factor, water levels, was probably the single most important factor affecting the dynamics of the fish population of Lake Chautauqua.

The principal benefit resulting from the increased fish-removal program at Lake Chautauqua was in economic gains to the participating commercial fishermen and in the utilization of the fish as food for man, food that otherwise would have been lost. (Auth. Summ.)

7816. Finger, Gary, and Robert H. Armstrong (Alaska Dept. of Fish and Game, Juneau). 1965. FISHERY AND BIOLOGICAL CHARACTERISTICS OF SALMON CAUGHT BY SPORT GEAR IN SOUTHEASTERN ALASKA. Alaska Dept. of Fish and Game Informational Leaflet 57, 58 p.

Excluding 1,325 salmon derby fish, 6,467 king and coho salmon were sampled for various fishery and biological factors during a two-year sport fish investigation from 4,559 boat trips in the Juneau and Ketchikan areas.

In both the Ketchikan and Juneau areas the catch per unit effort declined in the sport catch in the two years of the study. This was true for total salmon as well as for king salmon alone.

King salmon followed by coho salmon were the two most numerous species of salmon in the sport fishery. The other three species were not important in the catch and the order of abundance was pink, chum, and red salmon.

Coho salmon registered the highest catch per unit effort values during the period that they were available to the fisherman.

The sport-commercial fisherman showed a marked advantage in catching salmon, especially coho, when compared to the sport fisherman.

In the combined Juneau and Ketchikan areas, an estimated take (including salmon derbies) of approximately 3,600 salmon in 1960 and 3,000 salmon in 1961 was caught by the sport fisherman. King salmon accounted for approximately 2,000 in 1960 and 1,500 in 1961 of the total fish caught. The seasonal sport fishing and derby efforts in Juneau and Ketchikan consisted of approximately 5,000 boat trips in 1960 and 5,500 boat trips in 1961 with 12,200 fisherman and 14,200 fishermen, respectively.

The Southeastern Alaska sport fishery only harvested approximately 0.5 percent of the total catch of salmon by hook and line. Estimated total take of king salmon by the sport fishermen in Southeastern Alaska was 2,500 in 1960 and 2,000 in 1961. Approximately 1,600 coho were also harvested during both years.

The timing of the different species of salmon in the sport fishery was similar in the two years of the study with king salmon entering the fishery in late April, coho entering the fishery in late June, and with pink and chum salmon available in early July.

Outboard cabin boats between 16-20 feet were the most popular boats in the fishery, although the larger cabin boats showed a greater fishing success.

Trolling, although the most popular, was the least successful fishing method and was more successful with coho than with king salmon. Drift and anchored spinning were the most successful fishing methods.

Windy and rainy days were the least successful weather conditions in fishing for salmon. There was no advantage for any particular tide condition. The particular local areas of greatest fishing success were different for king and coho salmon and different for both years of the study.

The weights and lengths of king salmon decreased throughout the fishing season from a peak size in the spring with the males being slightly larger than the female salmon in both areas investigated. The king salmon in the Ketchikan area were larger than the Juneau kings for both years of the investigation.

An uneven sex ratio occurred in the king salmon sport fishery with 1.3 females in 1960 and 1.4 females in 1961 caught for each male king landed.

The more desirable red-fleshed king salmon were dominant in the catch in Southeastern Alaska with 71.5 percent in 1960 and 67.9 percent in 1961 having red flesh. (Auth. Summ.)

7817. Finger, Gary, and Robert Armstrong (Alaska Dept. of Fish and Game, Juneau). 1965. THE AGE COMPOSITION OF KING SALMON CAUGHT ON SPORT FISHING GEAR IN SOUTHEASTERN ALASKA. Alaska Dept. of Fish and Game Informational Leaflet 60, 16 p.

King salmon which have spent three years in saltwater were the age group most frequently caught by sport fishermen. As the season progressed the .2 aged kings (feeders) were more frequently caught while the .4 aged salmon decreased in numbers. The high percentage of male king salmon in the .2 age group, that are caught in May, probably indicated that this group consisted mostly of precocious male kings (jacks) that were on their spawning run. If a large percentage of the .2 age males returned to the rivers to spawn, this may be the reason for the higher percentage of .2 old females which entered into the catch later in the year and also the greater

female abundance of .3 and .4 age groups later in the season.

The mean length of the white fleshed king salmon was greater than the mean length of the red fleshed king salmon in the .2 and .3 age age groups, but the reason for this was not apparent. There appeared to be no sex differences in regards to flesh color except for the single exception in that the .3 age white females were larger than the red females.

The mean length of the .3 age group was greater in the month of May than the succeeding two to three months. This probably indicated that a fair percentage of these fish caught in May were of the larger sexually mature king salmon.

All of the above age comparisons were indicative of the many variations of king salmon stocks which enter into the Southeastern Alaska sport fishery. The complex life cycle of the king salmon and the many races which were probably harvested resulted in difficulty in separating the various age dependent variables in the king salmon sport fishery. (Auth. Summ.)

7818. Anonymous. 1964. LIFE HISTORY AND MIGRATION PATTERNS OF ARCTIC GRAYLING. Alaska Dept. of Fish and Game Research Report No. 2, 30 p.

Thirteen hundred Arctic grayling, Thymallus arcticus (Pallas), were collected from four habitats of the Tanana River drainage in Alaska. A description is given of each habitat which lists their general physical, chemical, and biological characteristics. Growth rates determined for the grayling in Alaska were less than those described in published reports from Canada and Montana. In Alaska, sexually immature grayling showed little growth differences between sexes; mature males grew faster than females. Stomach contents of specimens collected in May and June were composed largely of larval and nymphal aquatic insects. Spawning behavior did not differ from that described in published reports for the species. Eggs had an average diameter of 2.7 mm and were nonadhesive. Young-of-the-year fish, with approximately 17 weeks of summer growth, ranged from 54 mm to 96 mm and averaged 78 mm fork length. Electroshocking, seining, frame sets, incline traps, and hook and line methods were used to capture grayling for a study of migration patterns in tributaries of the Tanana River. A plastic subcutaneous tag proved very effective for fish more than 6 inches in total length; 907 tags were recovered from 9,210 tagged fish released. The movements of grayling in two tributaries are described. The copepod parasite, Salmincola edwardsii, was found on some grayling specimens from all areas sampled.

7819. Crutchfield, James. 1965. CAN WE PUT AN ECONOMIC VALUE ON FISH AND WILDLIFE? Colorado Outdoors, 14(2): 1-5.

Increasingly, fish and wildlife must compete with other uses of water and land resources. To refuse to use economic evaluations, or to attempt to use phony evaluations, means the eventual loss of fish and wildlife. To arrive at a decision regarding the relative value of sport and commercial fishing for some species we need to develop adequate, and generally-accepted, evaluation techniques.

7820. McClane, A. J. 1965. STRIPED BASS BREAKTHROUGH. Field and Stream, 70(3): 88-90, 92, 93.

The gizzard shad - striped bass combination is providing excellent sport in southern reservoirs. Improvements in culture techniques recently made possible the production of 100,000,000 fry from the eggs of 317 bass.

7821. Kobayashi, Tetsuo, Shigeru Harada, and Shin-ichi Abe. 1965. ECOLOGICAL OBSERVATIONS ON THE SALMON OF NISHIBETSU RIVER 1. THE MIGRATION AND GROWTH OF CHUM SALMON FRY, ONCORHYNCHUS KETA (WALBAUM). Scientific Reports of the Hokkaido Salmon Hatchery No. 19, pp. 1-10, Hokkaido, Japan.

Fry released at Nijibetsu Hatchery from the middle of January to the end of April appear at the mouth of the Nishibetsu River from late March to the end of June. Fry released after April are more active in their downstream migration than those released earlier. High, turbid water in the stream accelerates the movement of fry. Growth of chum salmon fry becomes greater with the warming of the water in May and June.

7822. Watanabe, Muneshige. 1965. ON THE SMOLTS OF THE RED SALMON (ONCORHYNCHUS NERKA) AT URUMOBETSU, ETOROF I., KURIL ISLANDS. Scientific Reports of the Hokkaido Salmon Hatchery No. 19, pp. 11-23, Hokkaido, Japan.

On the Asian side of the Pacific Ocean, Lake Urumobetsu, Kurile Islands, is the southern extremity of sockeye salmon ascent from the sea to a lake. Sockeyes reach the lake by ascending the river about 4 km., usually in July, and spawn about the end of the year. Most of the seaward bound smolts (over 95%) captured about 300 m. above the mouth of the river were 3rd-year fish, but there were a few 4th-year fish.

7823. Kubo, Tatsuro (Faculty of Fisheries, Hokkaido University, Hokkaido, Japan). 1965. ON THE INFLUENCE OF TEMPERATURE UPON THE ACCELERATION OF SMOLT-TRANSFORMATION IN JUVENILE MASU SALMON (ONCORHYNCHUS MASOU). Scientific Reports of the Hokkaido Salmon Hatchery No. 19, pp. 25-32.

The influence of temperature upon the changes of external appearances and some characteristics of blood of juvenile Masu salmon during the period of smolt-transformation was studied. Experiments were carried out with the juveniles in the early period of smolt-transformation. The experimental fish were reared at the higher temperature (9-14° C.) for about 25 days.

The result from the high temperature treatment on the fish in the early phase of the pre-smolt stage are two: first, a change in the body color to medium silver, and second, a marked rise in the osmoconcentration of the blood to a high level. These charac-

teristics in body color and blood concentration were comparable to those of wild fish in mid-smolt stage; whereas the fish reared at normal temperature (4-6° C.) during that period still remained in the stage of pre-smolt. The same experiment on the fish which had already reached the latter phase of the pre-smolt stage showed that, after the high temperature treatment, the fish attained to the post-smolt stage characterized by the thick guanine coat and the black tip of dorsal fin, and internally by the notable reduction of the osmoconcentration of the blood due to the acceleration of transformation; while in the control fish the characteristics of mid-smolt stage became conspicuous at that time.

Further, the chloride content, the density, the water content and the nitrogen content of blood in the experimental fish were significantly different from those of the controls.

Temperature might play an important role in the advancement of smolt-transformation in the juveniles of Masu salmon. (Auth.)

7824. Bardach, John E., Masaru Fujiya, and Arthur Holl (School of Natural Resources, Univ. of Michigan, Ann Arbor). 1965. DETERGENTS: EFFECTS ON THE CHEMICAL SENSES OF THE FISH ICTALURUS NATALIS (LE SUEUR). Science, Vol. 148, No. 3677, pp. 1605-1607.

Two types of detergents, one easily oxidized and the other not, damage the chemoreceptors of yellow bullheads, Ictalurus natalis (le Sueur) exposed to concentrations of 0.5 ppm in the surrounding water. This concentration is considerably lower than that at which sublethal damage has been detected previously. Histological examination reveals erosion of the taste buds; electrophysiological methods and observations of swimming and feeding behavior reveal impairment of receptor function. Affected fish do not fully recover after 6 weeks in detergent-free water. (Authors)

7825. Irwin, William H. (Oklahoma State University, Stillwater). 1965. FIFTY-SEVEN SPECIES OF FISH IN OIL-REFINERY WASTE BIOASSAY. Transactions of the Thirtieth North American Wildlife and Natural Resources Conference, Wildlife Management Institute, Wash., D.C., pp. 89-99.

Fifty-seven kinds of fish were studied to determine their use as bioassay animals and their relative resistance to oil refinery effluents. Seven papers, published and in press, derived from the study are summarized. Accepted bioassay methods were used; the effluent was taken directly at active refineries; and the fish were gathered from sixteen states. Variations in resistance and adaptability existed between both the kinds of fish and the individuals of a species.

The metabolic rates of individuals and species concerning oxygen, temperature and/or food requirements are limiting factors for some. Resistance rankings of fish; statistical treatments, quality items needed in specimens; behavior and life history; and suggestions for bioassay procedure are presented. The 24-hour median tolerance limits appeared to be as accurate as longer tests for the acute toxicity bioassay measurements when using oil refinery effluents. (Auth. Summ.)

7826. Rothschild, Brian J. (Bureau of Commercial Fisheries Biological Lab., Honolulu, Hawaii). 1965. HYPOTHESES ON THE ORIGIN OF EXPLOITED SKIPJACK TUNA (KATSUWONUS PELAMIS) IN THE EASTERN AND CENTRAL PACIFIC OCEAN. U.S. Fish and Wildlife Service, Special Scientific Report-Fisheries No. 512, 20 p.

A set of hypotheses has been formulated to account for the origin and movement of exploited groups of skipjack tuna (Katsuwonus pelamis) in the eastern and central Pacific Ocean. The hypotheses take into account the available evidence on larval distributions, gonad indices, size distributions, tag recoveries, catch predictions, and immunogenetic studies. The evidence suggests that most skipjack taken by the eastern Pacific skipjack fisheries originate in the central Pacific. It is likely that the equatorial region of the central Pacific contributes a major portion of the recruitment stock for the eastern Pacific. Large proportions of the Hawaiian catch also may originate in the Equatorial Zone. Skipjack catch predictions are discussed in the context of evidences which indicates that year-class-strength phenomena affect the Hawaiian landings. The need for more evidence on the origin and movements of harvested skipjack is emphasized. (Auth.)

7827. Lineaweaver, Thomas H., III. 1965. THE BLUEFISH. Sea Frontiers, 11(1): 14-22.

An account of what is known, and some of the unknowns, in the life history of the bluefish. Growth is rapid with 1+ fish ranging from 13.9 to 16.5 inches and 2+ fish from 15.0 to 20.1 inches.

7828. Gannon, John J., Jackson R. Pelton, and James Westfield (Dept. of Environmental Health, School of Public Health, Univ. of Mich., Ann Arbor). 1965. RESPIROMETER ASSEMBLY FOR BOD MEASUREMENT OF RIVER WATERS AND BIOLOGICALLY TREATED EFFLUENTS. Air and Water Pollution, 9(1/2): 27-40.

A respirometer assembly is proposed for the measurement of both BOD level and rate of river waters and biologically treated effluent, consisting of a standard 2-liter sealed reaction flask with a specially constructed galvanic cell oxygen electrode which acts as the oxygen sensing mechanism and which is tapered to fit through one of the standard port openings. Mixing is maintained in the reaction flask by means of a magnetic stirrer, and the oxygen electrode is connected to a standard strip chart recorder for continuous recording of oxygen concentration in the flask.

Operation of the assumbly for BOD measurement consists of aerating the sample and placing it in the sealed respirometer cell with the galvanic cell oxygen electrode. The whole assembly is then placed in a standard BOD incubator on a magnetic stirrer, with the oxygen electrode connected to a continuous recorder. When the oxygen concentration in the flask drops to 2 mg/l., the flask is aerated

by means of compressed air and the whole procedure is then repeated as long as it is desired to keep the rate running. The BOD, then, is the sum of the oxygen depletion with time.

Factors considered in the paper in relation to the assembly include a description of the apparatus, the general operating procedure, the precision of the oxygen electrode system, mixing considerations in the reaction flask, the BOD of any enclosed assembly components, and stability of electrode response during incubation. Also, the results of two separate runs involving river water and treatment plant effluent are presented, including various parallel controls involving the traditional method of running BOD rates.

The authors feel that the proposed respirometer assembly can be effectively used for obtaining a continuous measure of BOD with time, involving considerably less effort and providing more data than the conventional dilution or reaeration procedures. (Authors)

7829. Herbert, D. W. M., and D. S. Shurben (Water Pollution Research Laboratory, Stevenage, Herts., England). 1965. THE SUSCEPTIBILITY OF SALMONID FISH TO POISONS UNDER ESTUARINE CONDITIONS — II AMMONIUM CHLORIDE. Air and Water Pollution, 9(1/2): 89-91.

The resistance of yearling rainbow trout to ammonium chloride increases with salinity up to that of about 30 percent sea water, in which they can withstand about three times as much of the ammonium salt as in fresh water. Resistance decreases with a further increase in salinity to full-strength sea water. Yearling rainbow trout can just tolerate ammonium chloride concentrations which are from 1.2 to 2.5 times higher than those just tolerated by Atlantic salmon smolts. (Authors)

7830. Anonymous. 1965. WATER QUALITY CRITERIA FOR EUROPEAN FRESHWATER FISH. Air and Water Pollution, 9(3): 151-168.

This is the first of a series of reports on water quality criteria for European freshwater fish prepared for and approved by the European Inland Fisheries Advisory Commission. The background of the project is described and reasons for establishing water quality criteria for fish explained. This is followed by a literature survey of: the direct effects of solids in suspension on death or survival of fish, their growth, and resistance to disease; suspended solids and reproduction; effects on behaviour; effect on food supply; and total effect of suspended solids on freshwater fisheries. Finally tentative water quality criteria are suggested.

7831. Scott, W. B., and M. G. Scott (Royal Ontario Museum, Univ. of Toronto). 1965. A CHECKLIST OF CANADIAN ATLANTIC FISHES WITH KEYS FOR IDENTIFICATION. Univ. of Toronto Press, 106 p.

7832. Meyer, Fred P. (Bureau of Sport Fisheries and Wildlife, Fish Farming Experimental Station, Stuttgart, Arkansas). 1965. THE EXPERIMENTAL USE OF GUTHION AS A SELECTIVE FISH ERADICATOR. Transactions of the American Fisheries Society, 94(3): 203-209.

Channel catfish fingerlings exhibited a greater tolerance of Guthion than four other species of fish in laboratory tests. Under field conditions, 13 other species of fish were effectively removed by 1.0 ppm of Guthion without significant effects on catfishes. Differences in water quality and temperature did not affect the effectiveness of the chemical.

Food organisms were not permanently affected. Insect naiads were evident 10 days after treatments were applied. No difference in the abundance of zooplankters could be attributed to the application of the Guthion.

Fish killed by Guthion were not fit for consumption. Profound differences were noted between the residue levels in the flesh as compared to those in the offal of dressed fish. Offal contained up to 2.5 times as much residue as the flesh. Residue levels dropped sharply by the end of 1 week and were no longer detectable 6 weeks after exposure. (Auth.)

7833. Hilsenhoff, William L. (Dept. of Entomology, Univ. of Wisconsin, Madison). 1965. THE EFFECT OF TOXAPHENE ON THE BENTHOS IN A THERMALLY-STRATIFIED LAKE. Transactions of the American Fisheries Society, 94(3): 210-213.

Chaoborus larvae were the only profundal benthic organisms that were adversely affected by treatment of a dimictic lake with toxaphene to eradicate undesirable fish. The larvae were eliminated, and had not become reestablished 2 years after treatment. Subsequent to removal of the fish, an extremely large population of Chironomus larvae appeared, and when the lake was restocked with 7 species of fish, the population dropped to its former level. More than year after treatment, a substantial population of Procladius larvae appeared, probably resulting from the removal of carp and the consequent reduction of turbidity, increased growth of rooted aquatic vegetation, and restoration of higher dissolved oxygen levels. The temporary absence of fish also favored an increase in the physid snail population. (Auth.)

7834. Ryder, R. A. (Ontario Dept. of Lands and Forests Research Branch, Maple, Ontario). 1965. A METHOD FOR ESTIMATING THE POTENTIAL FISH PRODUCTION OF NORTH-TEMPERATE LAKES. Transactions of the American Fisheries Society, 94(3): 214-218.

Fish production (yield) is affected by three principal influences; the morphometric, edaphic, and climatic factors. Partial exclusion of the climatic factors reduces the complexity of the relationship of fish production and the other parameters. In this study of north-temperate lakes, the variability of the climatic factor is reduced to a minimum, and permits regression analyses of fish production on the morphometric and edaphic factors alone. Thirty-four north-temperate lakes were segregated into two groups; 23 lakes were moderately to intensively fished; 11 lakes had restricted catches or incomplete records. All 34 lakes satisfied criteria

of area, altitude, and climate. Regression of fish production on the "morphoedaphic" index for each group of lakes was highly significant. The morphoedaphic index, an expression of mean depth and total dissolved solids, provided a means for estimating the potential productivity of a north-temperate lake. (Auth.)

7835. Shetter, David S., and Gaylord R. Alexander (Mich. Dept. of Conservation, Hunt Creek Trout Research Station, Lewiston, Mich.). 1965. RESULTS OF ANGLING UNDER SPECIAL AND NORMAL TROUT FISHING REGULATIONS IN A MICHIGAN TROUT STREAM. Transactions of the American Fisheries Society, 94(3): 219-226.

The objective of this experiment was to compare angling quality for various sizes of trout in stream sections having two different sets of fishing regulations. Four anglers fished artificial flies and worm-baited hooks equal amounts of time in two stream sections, utilizing stratified random sampling procedures. Catch data were treated by analysis of variance, after transforming individual catch-per-hour data to: log [(catch/hour X 100) plus 1]

Total catch was 579 trout, 3.0 to 13.0 inches total length, in 192 hours; flies took 249 trout, worms caught 330 trout. Pertinent length categories into which the catch was separated were tested statistically.

Statistically significant differences in catch data, at or above the 95 percent confidence level, led to these conclusions:

A. Comparing catch by both lures in both waters:

1. More trout over 7 inches long were caught with worms than with flies. No significant difference was found for all trout.

2. The second quarter of the trout season was significantly better than the other three.

3. Morning and afternoon periods were consistently better than evening periods.

4. Significant differences were found between catches by anglers for all trout, but not for trout larger than 7 inches.

5. Significantly more trout of all sizes were caught in the special water than in normal water.

B. Comparing catch by flies in special water with both lures in normal water:

1. Significantly more legal trout were caught in normal water. The catch of all trout was found to be statistically nonsignificant between waters although a 60 percent advantage was noted for special water in empirical data.

C. Results of angling by test fishermen were similar to those for public anglers, except test anglers caught more sublegal trout on flies in special water than public anglers. (Authors)

7836. Schofield, Carl L., Jr. (Dept. of Conservation, Cornell University, Ithaca, New York). 1965. WATER QUALITY IN RELATION TO SURVIVAL OF BROOK TROUT, SALVELINUS FONTINALIS (MITCHILL). Transactions of the American Fisheries Society, 94(3): 227-235.

Periodic water analyses and simultaneous observations on the survival of various groups of test fish made in Honnedaga Lake during 1960 and 1961 indicated a relationship between water quality and trout survival. Periods of high acidity and heavy metals content, during the summer, were coincident with heavy mortality of brook trout from a hard-water and a soft-water hatchery; trout from a second hard-water hatchery, which contained zinc in its water supply, survived transfer to Honnedaga Lake. Chemical analyses of 30 nearby Adirondack lakes revealed two lakes of lower salinity, two of higher acidity, and one with a heavy metals content equal to that of Honnedaga. No other lakes exhibited the combined features of very low salinity, high acidity, and relatively high heavy metals content. (Auth.)

7837. Nakamura, Eugene L. (Bureau of Commercial Fisheries, Biological Laboratory, Honolulu, Hawaii). 1965. FOOD AND FEEDING HABITS OF SKIPJACK TUNA (KATSUWONUS PELAMIS) FROM THE MARQUESAS AND TUAMOTU ISLANDS. Transactions of the American Fisheries Society, 94(3): 236-242.

Stomach samples were examined from 603 skipjack (Katsuwonus pelamis) caught by live-bait fishing in waters surrounding the Marquesas and Tuamotu Islands from 1957 to 1959. The principal crustacean food consisted of stomatopods and megalops, while the main molluscan item was squid. The major fish items were acanthurids, gempylids, lutjanids, nomeids, scombrids, serranids, and synodontids. Larger skipjack ate comparatively more fish and less crustaceans. As expected, those from inshore areas had eaten more reef-originating organisms than had skipjack from areas farther offshore. No differences were found in food of the two sexes. Skipjack appeared to have heavy feeding periods in midmorning and in late afternoon hours, with a slack period during midday. This feeding pattern may be related: (1) to the distribution and abundance of forage organisms and zooplankton and their diurnal movements or (2) to a satiation of the food drive during midday. Confirmation of some of the trophic links in the food chain of skipjack was obtained by examination of the stomachs of the ingested fishes. The occurrence of juvenile tuna in the skipjack stomachs was higher than those reported from previous food studies of tuna from other areas. (Auth.)

7838. Wigley, Roland L., and Roger B. Theroux (Bureau of Commercial Fisheries Biological Laboratory, Woods Hole, Mass.). 1965. SEASONAL FOOD HABITS OF HIGHLANDS GROUND HADDOCK. Transactions of the American Fisheries Society, 94(3): 243-251.

Stomach contents of 941 juvenile and adult haddock collected at monthly intervals at the Highlands Ground off Cape Cod, Massachusetts, from February 1958 to January 1959 were analyzed. Approximately equal numbers of both sexes were represented. Weight of stomach contents from individual fish ranged from 0 to 48.2 grams; average weight was 2.2 grams. There were no indications of important differences between males and females in species of animals preyed upon or quantities of food ingested.

Mean stomach content weight increased as haddock size increased from 25 to 70 centimeters in length, but specimens longer than 70 centimeters contained unexpectedly small quantities of food. There was a marked seasonal variation in the quantity of food in the stomachs. A low feeding rate prevailed during late summer, fall, winter, and early spring, followed by heavy feeding in June. Water temperature appeared to be relatively unimportant in affecting the feeding rate. A wide variety of small benthic organisms were represented in the diet. The more important species are listed. The principal food groups, in order of decreasing importance were: Crustacea, Annelida, Pisces, Echinodermata, and Mollusca. Some differences in diet were associated with haddock size. Small organisms (amphipods, cumaceans, brittlestars) were more common in small haddock. Relatively large foods (decapod crustaceans, fish) were prevalent in large haddock only. Distinct seasonal changes in diet composition were detected. Crustacea and Pisces varied substantially and quite sharply, as opposed to Echinodermata which exhibited smaller, more gradual changes. The proportion of Annelida in the diet was quite uniform throughout the year. (Authors)

7839. Kramer, Robert H., and Lloyd L. Smith, Jr. (Dept. of Entomology, Fisheries, and Wildlife, Univ. of Minnesota, St. Paul). 1965. EFFECTS OF SUSPENDED WOOD FIBER ON BROWN AND RAINBOW TROUT EGGS AND ALEVINS. Transactions of the American Fisheries Society, 94(3): 252-258.

Brown and rainbow trout (Salmo trutta and S. gairdneri) eggs were held in continuous-flow suspensions of 0-, 60-, 125-, and 250-ppm conifer groundwood fiber 6 to 8 days before hatching. Resulting alevins were held in the same fiber concentrations until swimup (14 to 16 days), then removed and maintained in clean water for up to 91 days. Suspended fiber had no effect upon egg survival, respiration rate of embryos, or growth rates of alevins and juveniles from eggs incubated in fiber but hatched and grown in clean water. When alevins were held in wood-fiber suspensions, survival was reduced from 98 to 100 percent in controls to 0 to 72 percent in 250-ppm fiber; respiration rate from 336.6 mm^3/g per hour in controls to 146.3 in 125-ppm fiber; breathing rate from 1.39 to 1.92 respiratory movements per second in controls to 0.52 to 0.97 in 250-ppm fiber; heart rate from 1.50 to 1.60 beats per second in controls to 0.67 to 1.33 in 250-ppm fiber; and instantaneous growth rate (g) from .0213 to .0345 in controls to .0061 to .0062 in 250-ppm fiber. Growth rate of rainbow trout juveniles in clean water after exposure to fiber during the alevin stage was significantly reduced only in the 250-ppm-fiber group. Concurrent tests indicated that observed effects were due to the fiber and not to residues of a mercuric slimicide added to the fiber at the paper mill. (Authors)

7840. Berry, Richard J., Saul B. Saila, and Donald B. Horton (Narragansett Marine Laboratory, Univ. of Rhode Island, Kingston, R.I.). 1965. GROWTH STUDIES OF WINTER FLOUNDER, PSEUDOPLEURONECTES AMERICANUS (WALBAUM), IN RHODE ISLAND. Transactions of the American Fisheries Society, 94(3): 259-264.

Methods of age and growth analysis of winter flounder, Pseudopleuronectes americanus (Walbaum), in Rhode Island were investigated. The results indicated that age determinations from scale markings were unsatisfactory, and that fully reliable estimates from otoliths could be obtained only to age III. Modifications of Walford growth lines were used to describe growth in two populations of flounder. Estimates of total annual mortality were derived from age-frequency distributions for each sex and stock. (Authors)

7841. Schoumacher, Roger (Iowa Conservation Commission, 103 Sylvan, Bellevue). 1965. MOVEMENT OF WALLEYE AND SAUGER IN THE UPPER MISSISSIPPI RIVER. Transactions of the American Fisheries Society, 94(3): 270-271.

7842. Alt, Kenneth T. (Dept. of Wildlife Management, Univ. of Alaska, College, Alaska). 1965. FOOD HABITS OF INCONNU IN ALASKA. Transactions of the American Fisheries Society, 94(3): 272-274.

7843. Hartman, G. F. (Dept. of Recreation and Conservation, Vancouver, British Columbia). 1965. AN AQUARIUM WITH SIMULATED STREAM FLOW. Transactions of the American Fisheries Society, 94(3): 274-276.

Description of an aquarium which is portable, has a large observation area, and can be used with a limited water supply.

7844. Sinnhuber, R. O., J. H. Wales, R. H. Engebrecht, D. F. Amend, W. D. Kray, J. L. Ayres, and W. E. Ashton (Dept. of Food Science and Technology, Oregon State Univ., Corvallis). 1965. AFLATOXINS IN COTTONSEED MEAL AND HEPATOMA IN RAINBOW TROUT. Federation Proceedings, Vol. 24, No. 2.

Dry commercial trout rations have been implicated in the epizootics of liver cancer in rainbow trout. Wolf and Jackson (Science 142:676, 1963) demonstrated that the cottonseed meal in their rations was necessary for the development of trout hepatoma. Their investigations did not identify the active agent nor were they able to state whether it was extrinsic or intrinsic to cottonseed meal. In this study, aflatoxins were found to be present in a commercial trout ration causing hepatoma in rainbow trout. Cottonseed meal; solvent extracts of cottonseed meal or of rations containing cottonseed meal; and peanut meal were found by chemical assay and duckling tests to contain aflatoxins. Diets containing these materials and a purified test diet to which aflatoxins had been added produced microscopic liver tumors in 6 months and gross lesions of hepatocarcinoma in 9 months. Similar test diets without aflatoxin were negative. Cottonseed flour and gossypol and cyclopropene fatty acids (intrinsic to cottonseed) were not carcinogenic.

7845. Sadowsky, Victor (Institute of Oceanography, Caixa Postal 9075, Sao Paulo, Brazil). 1965. THE HAMMERHEAD SHARKS OF THE LITTORAL ZONE OF SAO PAULO, BRAZIL, WITH THE DESCRIPTION OF A NEW SPECIES. Bulletin of Marine Science, 15(1): 1-12.

Six species of hammerhead sharks were recognized among 645 specimens captured in depths of 4-10 m off Cananeia, Brazil (lat. 25°S, long. 47° 52'W), over a period of four years. These are: Sphyrna diplana, S. tiburo, S. tudes, S. zygaena, S. mokarran, and a new species herein described as Sphyrna nana. (Auth.)

7846. Clark, Eugenie, and Katherine von Schmidt (Cape Haze Marine Laboratory, Sarasota, Florida). 1965. SHARKS OF THE CENTRAL GULF COAST OF FLORIDA. Bulletin of Marine Science, 15(1): 13-83.

From January 1955 to April 1964, 762 sharks and 842 embryos of 16 species of sharks from the central west coast of Florida were examined. Included in order of abundance in our catches are: Carcharhinus leucas (135 specimens), C. milberti (109), Negaprion brevirostris (76), Carcharhinus limbatus (64), Sphyrna tiburo (63), Carcharhinus acronotus (61), Galeocerdo cuvieri (60), Ginglymostoma cirratum (58), Carcharhinus obscurus (49), Scoliodon terraenovae (22), Sphyrna mokarran (21), Carcharhinus maculipinnis (20), Mustelus norrisi (17), Sphyrna lewini (5), Aprionodon isodon (1), and Carcharias taurus (1). Measurements, seasonal distribution, embryonic development, maturity, and reproductive habits are discussed. (Authors)

7847. Elson, P. F., and C. J. Kerswill (Fisheries Research Board of Canada Biological Station, St. Andrews, N. B.). 1964. FOREST SPRAYING AND SALMON ANGLING. The Atlantic Salmon Journal, Number 3, pp. 20-29.

It is concluded that spraying of northern New Brunswick forests with DDT between about 1953 and 1958 has been responsible for a substantial portion of the recent severe depression in salmon fishing success, particularly in angling in this province, between 1959 and 1962. The complete absence of spraying in 1959 played a large part in the improved angling for grilse in 1963.

Not all of the depression nor all of the improvement should be attributed to presence or absence of spraying. Examination of catches in unsprayed areas, both nearer at hand and as far away as Newfoundland, show that there have been other influences too. For example, good summer rainfall, particularly in the pre-smolt year, has been found to be associated with improved commercial catches from a smolt year-class. The charts for several rivers show increased summer rainfall from 1961 on. It is also possible that rates of survival at sea have been better in the last few years. There seem to be hints of this when long-term variations in sea temperature are compared to commercial salmon catch trends.

7848. Lund, J. W. G. (The Freshwater Biological Association, Ambleside). 1965. THE ECOLOGY OF THE FRESHWATER PHYTOPLANKTON. . Biological Reviews, 40(2): 231-293.

Algal periodicity in lakes, and factors which determine the rise and fall of populations.

7849. Hamoir, G., and S. Konosu (Laboratory of General Biology, Faculty of Sciences, University of Liege, Belgium). 1965. CARP MYOGENS OF WHITE AND RED MUSCLES: GENERAL COMPOSITION AND ISOLATION OF LOW-MOLECULAR-WEIGHT COMPONENTS OF ABNORMAL AMINO ACID COMPOSITION. The Biochemical Journal, 96(1): 85-97.

The general composition of the carp myogens of white and red muscles was examined by electrophoresis and ultracentrifugation. Eight and nine peaks were found in the electrophoretic analysis at pH 7.3 and I 0.075 of white and red muscle respectively. Lowering of the pH to 5 or 6 did not increase the number of peaks. The electrophoretic pattern of white-muscle myogen was remarkably different from that of red-muscle myogen, though ultracentrifugal analyses of the both types of myogen gave similar diagrams, in which about one-third of the total myogen sedimented slowly. The pH-mobility curves of the myogen of white muscle indicated that the net charges of the components 2, 3, and 5 vary only slightly within the pH range 7.3-5.4, suggesting that their histidine content is very low. The slow-sedimenting fraction of white-muscle myogen was isolated in fairly good yield by ammonium sulphate fractionation, by taking advantage of their high salting-out range, and the fraction was shown to be composed mainly of components 2, 3, and 5. The same method of fractionation was applied to red-muscle myogen and the absence of the three components was confirmed. These results bring to light a new difference between the two types of fish muscle. (Authors)

7850. Konosu, S., G. Hamoir, and J. F. Pechère (Laboratory of General Biology, Faculty of Sciences, University of Liege, Belgium). 1965. CARP MYOGENS OF WHITE AND RED MUSCLES: PROPERTIES AND AMINO ACID COMPOSITION OF THE MAIN LOW-MOLECULAR-WEIGHT COMPONENTS OF WHITE MUSCLE. The Biochemical Journal, 96(1): 98-112.

The three main components of the 1.5-2s ultracentrifugal peak of carp myogen (white muscle) have been isolated by ammonium sulphate fractionation and zone electrophoresis, and crystallized. The molecular weights of these three proteins were determined by sedimentation and diffusion, by the Archibald method and by amino acid analysis, and found to lie between 9,000 and 13,000. Their complete amino acid compositions were determined by column chromatography and by their ultraviolet spectra. Both methods revealed abnormal compositions, including the absence of tryptophan and methionine and the presence of large amounts of phenylalanine. At most 1 residue each of tyrosine, cysteine, proline, arginine and histidine was found/molecule. The

specific viscosity of component 3 was lower than that of other small globular proteins described so far, a fact that suggests that these proteins approximate more closely to the ideal case of the spherical protein molecule. Also, the presence of a single residue of several amino acids, the absence of disulphide bonds, and the apparent reversibility of denaturation by urea of component 3 suggest that the study of these molecules could provide new information on the structure of proteins. (Authors)

7851. Pechère, J. F., and B. Focant (Laboratory of General Biology, Faculty of Sciences, University of Liege, Belgium). 1965. CARP MYOGENS OF WHITE AND RED MUSCLES: GROSS ISOLATION ON SEPHADEX COLUMNS OF THE LOW-MOLECULAR-WEIGHT COMPONENTS AND EXAMINATION OF THEIR PARTICIPATION IN ANAEROBIC GLYCOGENOLYSIS. The Biochemical Journal, 96(1): 113-118.

The combined low-molecular-weight protein components of the myogens from carp white and red muscles [about 30% (w/w) of the myogen proteins] have been isolated by gel filtration on Sephadex G-75 columns. The presence in this fraction from myogen of white muscle of the three main electrophoretic components previously isolated has been confirmed, and the low molecular weight of the fourth component in the myogen of red muscle, apart from myoglobin, has also been demonstrated. Glycogenolysis experiments in vitro have shown that the low-molecular-weight protein fraction from carp myogen does not contain enzymes from the Embden-Meyerhof chain. (Authors)

7852. Piggins, D. J. 1964. SALMON AND SEA TROUT HYBRIDS. The Salmon Research Trust of Ireland Incorporated, Report and Statement of Accounts, pp. 27-37.

F. 1 hybrids of salmon and brown trout (almost 5 years old at the end of 1964) reached an average length of 17.3 inches and were stripped for the third time. F. 2 hybrids resulting from earlier strippings were reared in ponds and released into a land-locked lake where their average size as 1+ fish was 10 inches, with some specimens of over 12 inches in length.

7853. Alabaster, J. S., and F. J. Durbin (Ministry of Agriculture, Fisheries and Food, London). 1964. BLOOD GROUPS IN SALMON, TROUT AND THEIR HYBRIDS. The Salmon Research Trust of Ireland Incorporated, Report and Statement of Accounts, pp. 38-39.

Serological research work on the blood groups of salmon, trout, and their hybrids suggest regional differences in the blood groups of Atlantic salmon and trout and also provide circumstantial evidence for the inheritance of blood groups in the hybrids.

7854. Kinney, Edward C. (Bureau of Sport Fisheries and Wildlife, Washington, D. C., 20240). 1965. ANNUAL REPORT FOR 1964 — COOPERATIVE FISHERY UNITS. Resource Status Report 3, U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, 32 p.

During the past school year, 337 students participated in the programs of the 13 cooperative fishery units. Unit staff members presented 23 formal courses in fishery subjects which were attended by 315 students. A total of 35 degrees, including 1 doctor of philosophy, 10 master of science, and 24 bachelor of science degrees, were awarded to fishery students affiliated with unit programs.

7855. Gopalakrishnan, V. (Central Inland Fisheries Research Institute, Barrackpore, West Bengal). 1964. RECENT DEVELOPMENTS IN THE PREVENTION AND CONTROL OF PARASITES OF FISHES CULTURED IN INDIAN WATERS. Proceedings of the Zoological Society, Calcutta, 17(1): 95-100.

Contrary to the belief of earlier workers that the control of parasitic diseases of fish is generally possible only in hatcheries, recent investigations undertaken at the Central Inland Fisheries Research Institute, Barrackpore, have shown that many ectoparasitic infections on cultured fishes could either be prevented or treated. Two methods are generally adopted for chemical treatment, viz., dip treatment, and group or pond treatment. The latter and the more recent method has been found to be effective in many stocking tanks in West Bengal. The parasitic infections discussed in the paper are those caused by Ichthyophthirius multifilis, Costia necatrix, Gyrodactylus sp., Argulus spp., Isoparorchis hypselobagri, Ligula sp., and Saprolegnia parasitica. Biological control methods appear to be more suitable in the case of infections caused by Ligula and and Isoparorchis hypselobagri. (Auth.)

7856. Holder, A. S. 1965. ICE FISHING IN LAKE SIMCOE. Fish and Wildlife Review, 4(1): 13-17.

A study has been initiated on the effect of heavy winter fishing upon the sport fish populations of Lake Simcoe, Ontario. Some 4,000 fishing huts on the lake provide about 6,200 hours of fishing and a harvest of 2,000 fish of all species. The catch consists mostly of whitefish, lake herring, and yellow perch.

7857. Johnston, D. R. 1965. PUBLIC FISHING PONDS FOR TROUT. Fish and Wildlife Review, 4(1): 18-24.

Rehabilitation and stocking of a 5-acre public fishing pond in southern Ontario provided 22,000 angler-days sport and a return of 5,300 of 7,100 brook trout stocked in 1963. Similar success in 1964 and overwhelming public acceptance of this operation has led to the management of other public fishing ponds in the area.

7858. Arnemo, Rolf (Institute of Limnology, Uppsala, Sweden). 1964. LIMNOLOGICAL STUDIES IN HYTTÖDAMMEN 1. PHYSICAL AND CHEMICAL CONDITIONS. Institute of Freshwater Research Report No. 45, Drottningholm, Sweden, pp. 6-93.

In this article an account is given of the physical and chemical conditions in Hyttödammen. Hyttödammen has an area of c. 12 ha and an average depth of

c. 1 m. It is used for rearing of first-summer, or one-year-old salmon. The pond receives water mainly from the river Dalälv via a flume, but some springs opening into the pond also contribute. The Dalälv and spring water have quite different chemical properties. For example, the specific conductivity of the spring water is c. $250 \cdot 10^{-6}$, whereas that of Dalälv water is c. $30—40 \cdot 10^{-6}$. The spring water is relatively richer in calcium and bicarbonate, in comparison with Dalälv water and standard composition.

The abundant vegetation, mainly Sagittaria sagittifolia L., has a great effect. Firstly, horizontal heterogeneity can build up, partly because of the influence of spring water; secondly, the most mobile ions (potassium, sodium and chloride) are taken up from the water. Because of leaching out of the sediment each year, in connection with draining the pond and removing the fish, the contents of these ions in the sediment are so low that Sagittaria's requirement for them cannot thereby be met. The remaining amounts are taken from the water, and during the vegetation period this causes movement from the water to the sediment. Sagittaria takes up the greater part of its nutrients through the roots. When the vegetation dies down the ions which have been taken up are released into the water. (Author's Summary)

7859. Dryer, William R., and Joseph Beil (Bureau of Commercial Fisheries Biological Laboratory, Ann Arbor, Mich.). 1964. LIFE HISTORY OF LAKE HERRING IN LAKE SUPERIOR. Fishery Bulletin, 63(3): 493-530.

The average annual commercial catch of lake herring (Coregonus artedi) in U.S. waters of Lake Superior was nearly 12 million pounds in 1929-61. This production contributed 62.4 percent of the total U.S. take of lake herring for the Great Lakes. About 90 percent of the annual catch is taken from small-mesh gill nets during the November-December spawning season.

The life-history studies were based on 12,187 fish collected in 1950-62; past growth was computed for 3,779 specimens collected from commercial landings at: Duluth, Minn.; Bayfield, Wis.; and Portage Entry and Marquette, Mich.

Age group IV dominated the catch in each year's collection at each port, followed by age groups III and V. The average age of the lake herring in the commercial samples was 3.9 years at Bayfield, Portage Entry, and Marquette, and 4.1 years at Duluth. With few exceptions, the mean age of the females exceeded that of the males.

The strength of the year classes varied considerably at each port but generally declined over the 1946-55 period. Fluctuations were similar at Bayfield and Marquette, but at neither port resembled closely the fluctuations at Portage Entry. Year classes 1954 and 1955 were, however, well below average at all three ports.

Females were larger than males (largest difference was 0.6 inch) at all ports except Marquette where the males held a slight advantage. With only one exception, the average lengths of the age groups were larger in 1956-59 than in 1950-55. The largest increase from the earlier to the later period was 1.1 inches for the V-group males at Portage Entry. In general, the average size of the lake herring increased from the western to the eastern part of the lake.

The weight of the lake herring in the combined samples increased as the 3.170 power of the length. Lake herring of corresponding lengths were heavier in 1956-61 than in 1950-55 (greatest increase was 8.8 percent at Bayfield). Port-to-port differences in average weight among fish of the same length in 1950-55 showed a west-to-east trend toward increased weight.

The calculated lengths and weights of fish from Duluth were smallest, followed by those from Bayfield, Portage Entry, and Marquette. With only one exception, the calculated lengths and weights of lake herring taken in 1956-59 were greater than those taken in 1950-55.

The trends in annual fluctuations of growth in length and weight were closely correlated among the three ports. Growth was generally below average in 1945-53 and above average in 1954-59.

The percentage of females equalled or exceeded that of the males in all age groups above I. The percentage of females, all age groups combined, was 68.5. The first mature males appeared in the 8.5- to 8.9-inch group; the first mature females were in the 9.5- to 9.9-inch group. All males were mature at lengths greater than 11.4 inches, and all females at lengths greater than 11.9 inches. The youngest mature lake herring belonged to age group II, and all fish older than age group III were mature. Spawning of Lake Superior lake herring normally is at its peak during the last week in November and the first week in December. The average number of eggs produced by female Lake Superior lake herring was 6,351.

Crustacea were the most common food and were found in 83 percent of the 146 stomachs examined.

The distribution of lake herring may be influenced by temperature, abundance of plankton, and spawning. The fish are most common near the surface in early summer, migrate to deeper water as the surface water warms, and are randomly distributed between the surface and about 20 fathoms in the late fall. (Authors)

7860. Fredin, R. A. (Bureau of Commercial Fisheries Biological Laboratory, Seattle, Wash.). 1964. OCEAN MORTALITY AND MATURITY SCHEDULES OF KARLUK RIVER SOCKEYE SALMON AND SOME COMPARISONS OF MARINE GROWTH AND MORTALITY RATES. Fishery Bulletin, 63(3): 551-574.

Four population models representing different temporal distributions of natural mortality during the ocean life of Karluk sockeye salmon (Onchorhynchus nerka) are developed and discussed. The first model simulates a constant monthly instantaneous mortality rate throughout ocean life of sockeye. In the second model, the monthly instantaneous mortality rate is greatest during the first month of ocean residence and decreases arithmetically in each

succeeding month. In the third model, the monthly instantaneous mortality rate decreases geometrically during the first 6 months of ocean life and remains constant thereafter. The fourth model simulates a "catastrophic', age-specific first-month instantaneous mortality rate and a constant, age-independent mortality rate in the second and succeeding months of ocean life.

Data collected on the releases and returns of marked Karluk sockeye in the late 1920's and early 1930's are used to estimate ocean mortality rates of the different fresh-water age groups of fish. The rates vary with the population model used, year of ocean life and fresh-water age. Mortality of the smaller, 3-fresh-water smolts is greater than for the larger, 4-fresh-water fish during at least a part of ocean residence.

Maturity schedules are estimated for 3- and 4-fresh-water smolts in each population model. Depending on the distribution of ocean mortality, from 53 to 62 percent of the 3-fresh-water fish and 74 to 80 percent of the 4-fresh-water sockeye achieve maturity by the end of their second year at sea.

The estimated instantaneous ocean mortality rates are compared with available estimates of Karluk sockeye ocean growth rates (weighted by the proportions of fish that mature as 1-, 2-, 3-, and 4-ocean sockeye) on a monthly and annual basis to determine the net increase or decrease in weight during ocean residence. Except during the last year of ocean life of the relatively small fraction of Karluk sockeye that spend 4 years at sea, and then only for the first of 4 mortality distributions considered, ocean growth exceeds natural mortality.

The ranges of the estimated increases in bulk of Karluk sockeye during the first, second, and third years of ocean life, respectively, are 609 to 1,035 percent, 54 to 144 percent, and 26 to 84 percent. During the fourth year of ocean life, the bulk of Karluk sockeye is estimated to decrease by 8 to 10 percent under the first population model, and increase by 11 to 38 percent under the other 3 models.

The estimated percentage changes in bulk show that, except for the relatively scarce 4-ocean fish under the first population model, any capture of Karluk sockeye before the end of their ocean life causes a loss of potential yield, provided there exists an inshore fishery capable of catching the fish not needed for reproduction of the stock. (Auth.)

7861. McNeil, William J. (Bureau of Commercial Fisheries Biological Laboratory, Auk Bay, Alaska). 1964. A METHOD OF MEASURING MORTALITY OF PINK SALMON EGGS AND LARVAE. Fishery Bulletin, 63(3): 575-588.

A method of estimating total mortality of salmon eggs and larvae from time of spawning to time of sampling is described. The method provides a measure of mortality, regardless of cause, and is unaffected by the disappearance of dead eggs or larvae.

Total mortality rate is calculated from estimates of abundance and fecundity of parent female spawners (potential egg deposition) and abundance of live eggs and larvae in spawning beds at the time of sampling. A hydraulic sampler, developed to collect samples of eggs and larvae, is described.

Two sources of bias are considered in mortality rates calculated from percentages of dead eggs and larvae in samples: (1) eggs not initially buried by spawners, and (2) eggs and larvae disappearing from the spawning bed. Neither source of bias exists where mortality is calculated from estimated potential egg deposition and abundance of live eggs and larvae at time of sampling.

The efficiency of estimating abundance of eggs and larvae is affected by their tendency to be clustered. Clustering causes the sample variance to increase with the sample mean, and confidence limits of estimates of abundance may be widely separated. The use of a logarithmic transformation improved the efficiency of estimates in certain instances.

A chi-square test based on the premise that a change in the total mortality level would be associated with a change in frequency of occurrence of dead or live eggs and larvae in samples is described. This test was useful in identifying periods when significant mortality occurred, especially where confidence limits of total mortality percentages were widely separated. (Auth.)

7862. Dryer, William R. (Bureau of Commercial Fisheries Biological Laboratory, Ann Arbor, Mich.). 1965. MOVEMENTS, GROWTH, AND RATE OF RECAPTURE OF WHITEFISH TAGGED IN THE APOSTLE ISLANDS AREA OF LAKE SUPERIOR. Fishery Bulletin, 63(3): 611-634.

A total of 1,303 whitefish were marked with spaghetti streamer tags in Wisconsin waters of Lake Superior in November of 1959, 1960, and 1961 and June-July 1960. The fish tagged in June-July 1960 were mostly undersized (less than 17 inches long) whereas those captured on the spawning grounds and tagged in November 1959-61 were almost all legal size. Of the 374 recoveries (28.7 percent), nearly all were made during the first 2 years after tagging. The earliest returns were from fish which were among the largest when tagged. Over one-half of the recoveries were made within 5 miles of the tagging site; the greatest distance traveled by an individual was 25 miles. The fish tagged in June-July 1960 grew 1.6 inches the first season and 1.2 the second. Of 27 whitefish recaptured within 6 months from the November 1959-61 group, 17 (63 percent) had lost length (range from decrease 0.1 to 1.4 inches). Whitefish of the June-July group recaptured during the second growing season after tagging gave an exploitation rate of 22.6 percent. First-year returns from the November 1959-61 tagging gave an exploitation rate of 20.5 percent. The true exploitation rate probably is higher since no allowance has been made for tagging mortality, loss of tags, or unreported recaptures. (Auth.)

7863. Mraz, Donald (Wisconsin Conservation Department, Madison). 1964. AGE, GROWTH, SEX RATIO, AND MATURITY OF THE WHITEFISH

IN CENTRAL GREEN BAY AND ADJACENT WATERS OF LAKE MICHIGAN. Fishery Bulletin, 63(3): 619-634.

This study is based on 1,023 whitefish, Coregonus clupeaformis (Mitchill)—819 in seven samples from five localities in central Green Bay in 1948-49 and 1951-52 and 204 in a single 1948 collection from northwestern Lake Michigan proper.

Records of age indicated unusual strength for only one year class—1943 which strongly dominated the 1948 sample from Lake Michigan and the 1949 sample from Green Bay and was well represented in the 1948 collection from Green Bay. Collections of 1951-52 without exception were dominated by age group III.

Length distributions of samples varied widely according to the age composition. Among fish more than 2 years old, the length distributions of age group overlapped broadly. Several 1-inch intervals included fish of four age groups.

The length-weight relation varied considerably among central Green Bay samples, but differences among localities were nearly equalled by the year-to-year difference at a single locality. Lake Michigan whitefish were generally lighter than those from Green Bay. Weight increased to the 3.386 power of length in Green Bay (combined samples) and the 3.59 power in Lake Michigan.

Growth in length, calculated by direct proportion from diameter measurements of growth fields on scales, differed among localities in central Green Bay and between samples of different years at a single locality. If permanent locality differences exist they are not large and can be obscured by the evident annual fluctuations of growth. The grand average calculated length of Green Bay whitefish (combined collections) exceeded that of Lake Michigan fish in all years of life. The advantage was greatest (2.2 inches) at 3 years (calculated lengths of 16.0 and 13.8 inches) and subsequently declined to 0.5 inch at 9 years (lengths of 24.6 and 24.1 inches). Both groups reached the minimum legal length of 17 inches during the fourth growing season. Green Bay whitefish also had the larger calculated weights. The advantage reached 9.3 ounces in 3 years (calculated weights of 22.4 and 13.1 ounces). In years of life 4-9, the weight advantage over Lake Michigan fish ranged from 8.7 ounces, (seventh year: weights of 74.4 and 65.7 ounces) to 12.2 ounces (ninth year; weights of 96.2 and 84.0 ounces).

Comparison of growth of whitefish at four localities in northern Lake Michigan indicates that fastest growth is in central Green Bay and slowest near the Fox Islands. Growth is intermediate and similar in northwestern Lake Michigan proper and northern Green Bay.

Youngest mature male whitefish in Green Bay belonged to age group II and youngest mature females to age group III. All IV-group fish were mature. Shortest mature males were at 14.5-14.9 inches and shortest mature females at 16.5-16.9 inches. All males longer than 17.9 inches and all females longer than 18.4 inches were mature. (Auth.)

7864. Mackiewicz, John S. (State Univeristy of New York, Albany). 1965. ISOGLARIDACRIS BULBOCIRRUS GEN. ET SP. N. (CESTOIDEA: CARYOPHYLLAEIDAE) FROM CATOSTOMUS COMMERSONI IN NORTH AMERICA. The Journal of Parasitology, 51(3): 377-381.

Isoglaridacris bulbocirrus gen. et sp. n. is described from Catostomus commersoni (Lacépède) in five states. Other hosts include C. catostomus (Forester) and Hypentelium nigricans (LeSueur). An inverted A-shaped ovary distinguishes the new genus from others in the Caryophyllaeidae. A single gonopore is present. The life cycle is unknown. (Auth.)

7865. Butler, Robert L. (Penn. State University, University Park), and David P. Borgeson (Calif. Dept. of Fish and Game, Sacramento). 1965. CALIFORNIA "CATCHABLE" TROUT FISHERIES. Calif. Dept. Fish and Game, Fish Bulletin, (127): 1-47.

Since 1954, about 7 million 7- to 8-inch rainbow trout (Salmo gairdnerii) have been stocked annually in California. Research to evaluate this program (cost in 1962-63, $1.4 million) was carried out during 1955-58. The characteristics of 20 representative "catchable" trout fisheries (7 lakes and 13 streams) were measured by short-term (1- to 3-week) creel censuses. Total harvest was estimated by plotting daily catch-per-hour against cumulative catch and fitting a straight line. The X intercept of this line is the estimated total harvest, and its slope is the instantaneous total mortality per hour of angling. The average harvest from 7 lakes was 83 percent, and from 13 streams 73 percent. One-half of the eventual harvest was caught within 2 to 9 days on streams, and within 4 to 12 days on lakes. The catchability of planted trout averaged seven times greater in streams than in lakes. Planted trout disperse readily in lakes but not in streams; hence, distributional practices can greatly affect the catchability of trout stocked in streams. Angling effort was proportional to the number of trout stocked annually. Daily effort averaged 3.5 hours per acre on lakes and 102.5 hours per mile on streams. The returns of 8.0- to 8.9-inch trout averaged 15 percent higher than those of trout 7.0 to 7.9 inches long. The unweighted average catch-per-angler-hour for study streams was 0.94, and for lakes 0.60. Thus, to provide equal angling days, three trout must be stocked in streams for every two in lakes (assuming equal harvest). "Truck following" and associated distasteful angling conditions result when individual plants are too large. Among the waters studied, this problem was most acute on small streams The data indicate that the largest (therefore the most economical) plant size that will eliminate "truck following" is one that allows about one-half of the trout to survive until the next plant is made. A formula is presented that enables the calculation of this plant size from creel census data. (Authors)

7866. Clemens, Harold B. and William L. Craig (Calif. Dept. Fish and Game, Terminal Island). 1965. AN ANALYSIS OF CALIFORNIA'S ALBACORE

FISHERY. Calif. Dept. of Fish and Game, Fish Bulletin, (128): 1-301.

Historical records of California's sport and commercial albacore (Thunnus alalunga) fisheries were compiled and analyzed. The results led to hypotheses which offered an explanation for the spectacular failure of the fishery during 1930's and provided information concerning present-day migration patterns, which has led to predictions.

Albacore movements were markedly affected by sea temperature. The location of some migrations changed by hundreds of miles, depending upon the geographic orientation of optimum temperatures. Each run (as a unit) behaved according to its size or age composition, and fishing success within various ocean temperatures depended upon both the makeup of the migration and its magnitude.

The number of albacore in the seasonal migrations remained fairly consistent during 1950-1961, despite large changes in size composition and an average fishing pressure of over 1,000 vessels.

We can estimate the condition of the albacore resource when equivalent catch data from throughout its geographical range have been assembled and analyzed. This paper is California's contribution to a proposed international exchange. (Authors)

7867. Goldberg, Erwin (Dept. Biological Sciences, Northwestern Univ., Evanston, Illinois). 1965. LACTATE DEHYDROGENASES IN TROUT: EVIDENCE FOR A THIRD SUBUNIT. Science, Vol. 148, No. 3668, pp. 391-392.

Various tissues of the brook trout contain as many as nine forms of lactate dehydrogenase, an indication that at least three polypeptide subunits synthesized under the control of three nonallelic genes take part in the lactate dehydrogenase composition of this species. There was no evidence of a spermatozoan-specific lactate dehydrogenase. (Auth.)

7868. Fremling, Calvin R. (Winona State College, Winona, Minnesota). 1964. MAYFLY DISTRIBUTION INDICATES WATER QUALITY ON THE UPPER MISSISSIPPI RIVER. Science, Vol. 146, No. 3648, pp. 1164-1166.

Hordes of mayflies emerge during the summer months from most sections of the upper Mississippi River, thus creating nuisance problems for shoreline residents and river traffic. The presence of these pollution-sensitive forms indicates, however, that the river is more river-like than sewer-like in a given area. (Auth.)

7869. Eales, J. G. (Dept. of Zoology, Univ. of British Columbia, Vancouver, B. C., Canada). 1964. THE INFLUENCE OF TEMPERATURE ON THYROID HISTOLOGY AND RADIOIODINE METABOLISM OF YEARLING STEELHEAD TROUT, SALMO GAIRDNERI. Canadian Journal of Zoology, 42(5): 829-841.

The thyroid activity of yearling steelhead, as measured by radioiodine methods (CR and T/S), increased with temperature from 6 to 18° C. The thyroid uptake of I^{131} peaked at 12° C. However, this method was found unreliable, since plasma I^{131} clearance, upon which it depends, also increased with temperature.

The staining reaction of the colloid (Azan stain) indicated greater thyroid activity at high temperatures. On the other hand, measurements of thyroid mean epithelial height implied greater activity at low temperatures.

A hypothesis resolving anomalies between various criteria of thyroid activity, based on a TSH-independent influence of temperature on the poikilotherm thyroid is presented. (Auth.)

7870. Beamish, F. W. H. (Fisheries Research Board of Canada, Biological Station, St. Andrews, N. B., Canada). 1964. RESPIRATION OF FISHES WITH SPECIAL EMPHASIS ON STANDARD OXYGEN CONSUMPTION. IV. INFLUENCE OF CARBON DIOXIDE AND OXYGEN. Canadian Journal of Zoology, 42(5): 847-856.

Oxygen consumption was determined in relation to spontaneous activity and standard metabolism estimated by extrapolating the values to zero activity. Standard oxygen consumption was determined in relation to different partial pressures of carbon dioxide and oxygen for brook trout, Salvelinus fontinalis (Mitchill), at 10° C., and carp, Cyprinus carpio Linnaeus, at 25° C. In general, at each partial pressure of oxygen applied, standard oxygen consumption did not change significantly over the range of partial pressures of carbon dioxide followed. The relation for brook trout operated on a level characteristic of the partial pressure of oxygen. Although the effect of different levels of oxygen was not established for carp at 25° C., it is presumed that the relation operated also in that species in a similar way.

Acclimation to the different levels of carbon dioxide and oxygen to be tested was examined and, ordinarily, found not to change significantly the standard rate of oxygen consumption. (Auth.)

7871. Battle, Helen I., and Kaye Hayashida (Dept. of Zoology, Univ. of Western Ontario, London, Ontario). 1965. COMPARATIVE STUDY OF THE INTRAPERITONEAL ALIMENTARY TRACT OF PARASITIC AND NONPARASITIC LAMPREYS FROM THE GREAT LAKES REGION. Jour. of the Fisheries Research Board of Canada, 22(2): 289-306.

The macroscopic and microscopic anatomy of the intraperitoneal alimentary tract of two parasitic species of lamprey, Petromyzon marinus and Ichthyomyzon unicuspis, and two nonparasitic species, Entosphenus lamottenii and Ichthyomyzon fossor, are described and compared. In adults of both parasitic species a diverticulum of the anterior mid-gut occurs at the level of the posterior oesophagus; and longitudinal mucosal folds or rugae greatly increase the internal surface of the mid-gut. The course of the mid-gut spiral valve shows species variation, and is more complex in parasitic than nonparasitic adults. Throughout most of the tract tall cilia occur on epithelia over the tips of folds, whereas short cilia form tracts in the fornices. Extra-epithelial tunics are composed of fibro-elastic connective tissue,

circular smooth muscle, and a serosa. The four species can be distinguished on the bases of the mucosal folds, spiral valve, and the lining epithelium of the oesophagus.

Atrophy of the tract of both parasitic species commences with the spawning migration, when the epithelium exhibits a characteristic cytolysis with vacuolation of the cytoplasm and peripheral migration of the nuclei. In Entosphenus lamottenii atrophy involves initial necrosis of the epithelium and subsequently of the extra-epithelial tunics, both accompanied by massive infiltration of lymphocytes, whereas in Ichthyomyzon fossor it is resultant upon autolysis of some of the epithelial cells with progressive reduction in the diameter of the tract without interruption of the lining layer. (Authors)

7872. Saunders, Richard L. (Fisheries Research Board of Canada Biological Station, St. Andrews, N. B.). 1965. ADJUSTMENT OF BUOYANCY IN YOUNG ATLANTIC SALMON AND BROOK TROUT BY CHANGES IN SWIMBLADDER VOLUME. Jour. of the Fisheries Research Board of Canada, 22(2): 335-352.

The adjustment of swimbladder volume and the consequent effects on buoyancy in young Atlantic salmon and brook trout at various stages of development were measured in relation to current velocity. This was done by measuring pressure of neutral buoyancy—the pressure at which an anesthetized fish just reached neutral buoyancy as the total (atmospheric plus hydrostatic) pressure was gradually reduced—or by measuring flotation pressure—the ratio of volume of gas in the swimbladder to weight of the gas-free fish in water. Whether in static or flowing water, salmon parr were less buoyant than brook trout. Individuals of both species were more buoyant when held in still water than when held in rapidly flowing water. Adjustment in buoyancy took place when these fishes were subjected to a change in water current. Buoyancy was reduced if they were moved from still water to rapidly flowing water and was increased if they were moved from flowing to still water. Salmon smolts were more buoyant than salmon parr. This greater buoyancy of smolts is not owing to their being larger than parr. Initial filling of the swimbladder in salmon alevins can be delayed by subjecting them to strong water currents. (Auth.)

7873. Pinhorn, A. T., and C. W. Andrews (Memorial University of Newfoundland, St. John's, Newfoundland). 1965. EFFECT OF PHOTOPERIODS ON THE BEHAVIOR OF JUVENILE ATLANTIC SALMON (SALMO SALAR L.) IN VERTICAL AND HORIZONTAL LIGHT GRADIENTS. Jour. of the Fisheries Research Board of Canada, 22(2): 369-383.

The behavior of juvenile Atlantic salmon in vertical and horizontal light gradients was studied. Comparisons were made between the behavior of fish exposed to 16-hour photoperiods (long-photoperiod fish) and fish that had not been so conditioned (control fish). In vertical light gradients the long-photoperiod fish were very active and moved rapidly up and down the water-column. At low light intensities they tended to rise into the surface layers. Peak activity and the greatest numbers in the upper reaches of the water-column occurred at 0.04 ft-c (lowest intensity studied). The control fish, however, were relatively quiescent at all light intensities and settled to the bottom at low light intensities. Peak activity and the greatest numbers in the upper reaches of the water-column occurred at 1.0 ft-c. In horizontal light gradients the control and long-photoperiod fish remained in areas of lowest light intensities. When allowed to remain in the light gradients for a short period of time, both groups showed a stronger avoidance of light sources of higher intensity but moved into the brighter areas with low intensity light sources. With prolonged stay in the light gradients, these trends were essentially reversed due to nipping and defence of territory. The long-photoperiod fish showed a stronger avoidance reaction than the control fish with the 100-watt light source, whereas the reactions of both groups were similar with the 7-1/2-watt and 300-watt light sources, when these fish were allowed to remain in the gradients for a short period of time. However, with prolonged stay in the gradients, nipping and defence of territory resulted in a stronger avoidance reaction by long-photoperiod fish to all light gradients. The differences in the behavior of control and long-photoperiod fish in vertical and horizontal light gradients is believed to be a result of exposure of the latter to controlled photoperiods. (Authors)

7874. Saunders, J. W., and M. W. Smith (Fisheries Research Board of Canada Biological Station, St. Andrews, N. B.). 1965. CHANGES IN A STREAM POPULATION OF TROUT ASSOCIATED WITH INCREASED SILT. Jour. of the Fisheries Research Board of Canada, 22(2): 395-404.

Low standing crops of brook trout, Salvelinus fontinalis, were closely associated with silting in Ellerslie Brook, Prince Edward Island, and appeared to result from the destruction of hiding places. Spawning was also curtailed by silting. Following scouring, trout stocks soon increased. The remarkable adaptability of trout to silting, in a habitat with favourable flow and water temperature, was illustrated. (Authors)

7875. Brett, J. R., and D. B. Sutherland (Fisheries Research Board of Canada Biological Station, Nanaimo, B. C.). 1965. RESPIRATORY METABOLISM OF PUMPKINSEED (LEPOMIS GIBBOSUS) IN RELATION TO SWIMMING SPEED. Jour. of the Fisheries Research Board of Canada, 22(2): 405-409.

By use of a "tunnel" respirometer the relation between oxygen consumption (Y, mgO_2/kg/hr) and swimming speed (X, body lengths/sec) for 45-g pumpkinseed at 20° C. was found to follow the equation $\log_{10} Y = 1.65 + 0.31 X$. Standard and active metabolic rates were 45 ± 6.6 and 408 ± 39 mg O_2/kg/hr, respectively. Maximum 60-min sustained swimming speeds averaged 3.01 ± 0.27 lengths/sec.

At low velocities, with more than one fish present, elevation of the metabolic rate occurred from aggressive behaviour, reaching one-half the active rate. (Authors)

7876. Scarratt, D. J., and P. F. Elson (Fisheries Research Board of Canada Biological Station, St. Andrews, N. B.). 1965. PRELIMINARY TRIALS OF A TAG FOR SALMON AND LOBSTERS. Jour. of the Fisheries Research Board of Canada, 22(2): 421-423.

A description is given of a new design of toggle tag which can be easily embedded in the musculature of small marine animals. A brief account is included of preliminary trials on Atlantic salmon, cod, and lobsters. (Authors)

7877. Sprague, J. B., and B. Ann Ramsay (Fisheries Research Board of Canada Biological Station, St. Andrews, N. B.). 1965. LETHAL LEVELS OF MIXED COPPER-ZINC SOLUTIONS FOR JUVENILE SALMON. Jour. of the Fisheries Research Board of Canada, 22(2): 425-432.

The toxicity of copper and zinc sulphates to juvenile Atlantic salmon (Salmo salar L.) was tested in very soft water at 17° C. The salts were tested separately and in mixtures. Incipient lethal levels were 32 µg/litre of copper alone or 420 µg/litre of zinc alone.

Concentrations were expressed in "toxic units" by taking them as proportions of incipient lethal levels. Compared this way, resistance-times were similar for the two metals. Experiments showed that the incipient lethal level for mixtures was attained when addition of toxic units contributed by each metal reached a total of 1.0. The lethal threshold was therefore governed by simple additive effect of the two toxicants. This result is useful for applying to pollution problems in the field.

In stronger mixtures totalling 2 and 5 toxic units, fish died faster than would be expected from their resistance to the metals separately. This type of potentiation in short-term tests seems to account for more-than-additive effects previously reported in the literature. (Authors)

7878. Byrd, I. B., and Johnie H. Crance (Alabama Dept. of Conservation, Division of Game and Fish, Montgomery). 1965. FOURTEEN YEARS OF MANAGEMENT AND FISHING SUCCESS IN ALABAMA'S STATE-OWNED PUBLIC FISHING LAKES. Transactions of the American Fisheries Society, 94(2): 129-134.

Twenty state-owned lakes containing 1,733 acres were opened to public fishing for 1 to 14 years during the period of 1950 to 1964 and provided a total of 13,695 acre-years of fishing. During this 14-year period, a total of 1,844,397 fishermen caught 7,855,325 fish weighing 2,375,788 pounds which included 413,876 largemouth bass (Micropterus salmoides) weighing 395,222 pounds. These lakes, therefore, provided per acre an annual average of 135 fisherman-trips and a catch of 573 fish weighing 173 pounds including 30 largemouth bass weighing 29 pounds. The highest average catch of 224 pounds per acre occurred during the first year of fishing following opening. The average catch per acre during each of the following 13 years ranged from 151 pounds during the third year to 202 pounds for the fourteenth year. Approximately 7,380,000 visitors, in addition to fishermen, used the lake areas for picnicking, hiking, camping, swimming, and boating. Revenues received from the sale of fishing permits and boat rental fees were adequate to cover costs of management, operation, and maintenance. Management consisted of fertilization, partial poisoning with rotenone, restocking of fingerling largemouth bass, and annual spraying of 2,4-D to control marginal vegetation. (Authors)

7879. Ghent, A. W., and B. Grinstead (Univ. of Illinois, Urbana). 1965. A NEW METHOD OF ASSESSING CONTAGION, APPLIED TO A DISTRIBUTION OF REDEAR SUNFISH. Transactions of the American Fisheries Society, 94(2): 135-142.

The method of binomial corner-association analysis proposed in this paper is applicable to data from grids of contiguous cells, all or most of which are sampled. After sampling, the frequency distribution of cells at successive densities is grouped into a series of successive density categories. A separate binomial analysis is then conducted for each density category, in which the unit of observation is the number, from 0 to 4, of cells of the same density category which occur around each point of intersection on the grid. Applied to a distribution of the redear sunfish (Lepomis microlophus (Günther)) in a small lake in Oklahoma, the method revealed that unoccupied cells, and cells occupied at medium and at high densities, were contagiously distributed; low density cells, however, were acceptably random. The rationale of this analytical method is compared with that of inherently single-dimensioned analyses such as the Poisson and negative binomial. Corner-association analysis is shown to be inherently two-dimensional, and to have the additional advantage of focussing attention upon the interaction of the species and the environment, such interactions producing contagion at some density levels and randomness at others. (Authors)

7880. Hoffman, Glenn L., and Robert E. Putz (Bureau of Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Leetown, West Virginia). 1965. THE BLACK-SPOT (UVULIFER AMBLOPLITIS: TREMATODA: STRIGEOIDEA) OF CENTRARCHID FISHES. Transactions of the American Fisheries Society, 94(2): 143-151.

Adult Uvulifer ambloplitis were recovered from a kingfisher and the worm eggs were incubated. Helisoma snails were infected with the resultant miracidia. Cercariae, very similar, but not identical to Cercaria bessiae, were recovered and used to infect fish. It was possible to infect Lepomis macrochirus, but not Catostomus commersoni, Cottus bairdi, Carassius auratus, Notropis cornutus, N. rubellus, N. spectrunculus, Semotilus atromaculatus, S. corporalis, S. margarita, Ictalurus punctatus, Etheostoma flabellare or Salmo gairdneri.

Development of the metacercaria was studied at 13° C., 21° C., and 24° C. There was almost no development at 13° C. and development was about twice as rapid at 24° C. as at 21° C. The origin of the cyst of parasite origin is discussed. The metacercariae live at least 4-1/2 years in the fish at

12° C. The adult is briefly described and compared with other species. A key to the adults is given. (Authors)

7881. Croker, Robert A., and Alfred J. Wilson (U.S. Bureau of Commercial Fisheries Biological Laboratory, Gulf Breeze, Florida). 1965. KINETICS AND EFFECTS OF DDT IN A TIDAL MARSH DITCH. Transactions of the American Fisheries Society, 94(2): 152-159.

A tidal marsh ditch near Pensacola, Florida, was treated with 0.2 pound of DDT per acre in March 1963, and observed for 4 months. Ninety-eight percent of the animal mortality occurred within 3 weeks after treatment. A population of cyprinodont fish was restored by reproduction of surviving and introduced fish. DDT was detected in surface water samples 8 days after treatment but not after 14 days, while DDT was not detected in bottom water samples later than 1 day after treatment. Seven weeks after treatment, vegetation samples averaged 9.1 ppm of DDT, after reaching a maximum of 75 ppm of DDT 3 to 4 weeks after treatment. Sediment samples yielded more variable residues, averaging 0.76 ppm of DDT at 7 weeks after reaching a maximum of 3.35 ppm of DDT 6 weeks after treatment. Fish accumulated up to 90 ppm of DDT within 5 weeks after treatment. Highest DDT residues detected in fiddler crabs and snails ranged from 15 to 25 percent of the average residues detected in fish. The net water movement as indicated by the distribution of Rhodamine B dye, the general distribution of DDT residues in all samples, and the difference in mortality of fish at two holding sites, indicated an accumulation of DDT in the lower marsh after treatment. (Authors)

7882. Dryer, William R., Leo F. Erkkila, and Clifford L. Tetzloff (Bureau of Commercial Fisheries, Ashland, Wisconsin). 1965. FOOD OF LAKE TROUT IN LAKE SUPERIOR. Transactions of the American Fisheries Society, 94(2): 169-176.

Stomachs were examined from 1,492 lake trout and 83 siscowets collected from Lake Superior. Data are given on the food of lake trout of legal size (17 inches or longer) by year, season, and depth of water, and on the relation between food and size among smaller lake trout.

Fish contributed 96.7 to 99.9 percent of the total volume of food in the annual samples. Ciscoes (Coregonus spp.) were most common (52.2 to 87.5 percent of the volume) in 1950 to 1953 and American smelt ranked first (65.6 percent of the volume) in 1963. Cottids were in 8.9 to 12.3 percent of the stomachs in 1950 to 1953 but in only 4.3 percent in 1963. Insects ranked second to fish in occurrence (9.6 percent for the combined samples) and crustaceans followed at 3.9 percent.

The greatest seasonal changes in the food of lake trout were among fish caught at 35 fathoms and shallower. The occurrence of Coregonus increased from 34.6 percent in February-March to 71.1 percent in October-December. Smelt were in 76.9 percent of the stomachs in February-March but in only 2.2 percent in October-December. Cottids, Mysis relicta, and insects were most common in the July-September collections.

Lake trout taken at depths greater than 35 fathoms had eaten a higher percentage of Cottidae and Coregonus than had those captured in shallower water. Smelt, ninespine sticklebacks, Mysis, and insects were more frequent in stomachs of lake trout from less than 35 fathoms.

Crustaceans comprised more than 70 percent of the total volume of food for 4.0- to 7.9-inch lake trout but their importance decreased as the lake trout grew larger. Pontoporeia affinis was the most common in the stomachs of 4.0- to 4.9-inch lake trout, and Mysis held first rank at 7.0 to 12.9 inches. Ostracods were important only to 4.0- to 4.9-inch lake trout. As the lake trout became larger, the importance of fish grew from 4.4-percent occurrence at 5.0 to 5.9 inches to 93.9 percent at 16.0 to 16.9 inches. Smelt were most commonly eaten by undersize (less than 17 inches) lake trout. (Authors)

7883. French, Robert R. (U.S. Bureau of Commercial Fisheries, Seattle, Washington). 1965. VISCERAL ADHESIONS IN HIGH-SEAS SALMON. Transactions of the American Fisheries Society, 94(2): 177-181.

Multiple mesenteric and peritoneal adhesions were recorded in sockeye and chum salmon obtained in 1957 through 1964 during the high seas sampling program. These adhesions were more prevalent among sockeye salmon examined during the 1963 summer research cruise in the North Pacific and winter cruise of 1964, with approximately 9 and 25 percent respectively of the salmon afflicted. Adhesions were rare among chum salmon and not recorded among other salmon species. Of the sockeye with adhesions, most were fish which had spent 2 winters at sea, most were immature at time of capture, and the majority were males.

Visceral adhesions among salmonids reported in the literature are reported to be from infections of the nematode Philonema sp. The relationship between Pacific salmon and Philonema is unknown; also unknown is the ultimate effect on salmon of visceral adhesions. (Auth.)

7884. Zimmer, Paul D., and John H. Broughton (Bureau of Commercial Fisheries Program Office, Portland, Oregon). 1965. ANNUAL FISH PASSAGE REPORT – ROCK ISLAND DAM COLUMBIA RIVER, WASHINGTON, 1964. U.S. Fish and Wildlife Service, Special Scientific Report—Fisheries No. 515, 23 p.

Fish using the three fishways at Rock Island Dam in 1964 were counted from May 1 to October 24. The total number of salmon and steelhead trout exceeded the 1963 count by 7,885 fish.

The 1964 count of 39,951 chinook salmon was more than twice the mean of 17,355 for the 31-year period 1933-63 and exceeded the 1963 count by 5,263 fish. The 69,411 sockeye salmon counted was 4,643 more than recorded in 1963 and exceeded the 31-year mean of 51,603. The 61 coho salmon counted was about 75 percent of the 31-year mean of 81 and 8 percent of the record count of 737 in 1962. The 5,016 steelhead trout count in 1964 was

well above the 31-year mean of 3,457 and 2,062 less than in 1963. Fish other than salmon and steelhead trout passing through the fishways at Rock Island Dam in 1964 numbered 118,284 and exceeded the count of salmon and steelhead trout by 3,845 fish. (Authors)

7885. Griffiths, Raymond C. (Univ. of California, Inst. of Marine Resources, Scripps Institution of Oceanography, La Jolla, Calif.). 1965. A STUDY OF OCEAN FRONTS OFF CAPE SAN LUCAS, LOWER CALIFORNIA. U.S. Fish and Wildlife Service, Special Scientific Report—Fisheries No. 499, 54 p.

The general concept of a front is discussed, with some emphasis on the problem of strict definition and on the probable effects of a front on the biota. A note is made of the lack of precise studies, particularly biological studies.

Some of the difficulties in obtaining observations at five fronts off Cape San Lucas are mentioned.

Data from two cruises in April and May 1960 are used to depict the main oceanographic features of the area at large.

The most easily studied, sharpest, and most stable front was found off Cape San Lucas on a cruise in April 1961. Here warm, saline Gulf of California water moved slowly, inshore, while cool, less saline California Current water moved slowly eastward offshore, the front being maintained between them. Profiles of all the main oceanographic variables across the best studied front were drawn from data of two triplets of hydrocasts, a day apart, across the front. The vertical temperature and salinity distributions showed the interface between the two water masses to be Z-shaped.

Animal and plant plankton and nekton were measured in relation to this front, but the evidence for accumulation of biota at the front is not conclusive.

Four other fronts were studied, though not as thoroughly; the data from them are used to illustrate certain difficulties in studying fronts. (Author)

7886. Buck, Homer D., and Charles F. Thoits III (Illinois Natural History Survey, Urbana). 1965. AN EVALUATION OF PETERSEN ESTIMATION PROCEDURES EMPLOYING SEINES IN 1-ACRE PONDS. The Journal of Wildlife Management, 29(3): 598-621.

Seines were used to make Petersen estimates of various size or age components of single-species fish populations in 15 1-acre ponds at the former McGraw Hydrobiological Laboratory near Dundee, Illinois. All estimates were checked by draining censuses. Each of the five species of fish involved was by itself in three of the ponds. Combinations of fin-clip marks permitted a maximum of seven separate estimates for each of the several size or age-groups of each species; together these constituted a total of 274 individual estimates. Analyses applied to the estimates and census data indicated that significant bias occurred most often in the bluegill (Lepomis macrochirus) estimates (70 percent of 37), least commonly among yellow perch (Perca flavescens) estimates (13 percent of 63), intermediately in smallmouth bass (Micropterus dolomieui) and largemouth bass (Micropterus salmoides) estimates (16 percent of 45 and 18 percent of 61, respectively), and brown bullhead (Ictalurus nebulosus) estimates (25 percent of 56). Although errors of estimate were lowest for perch, 54 percent of the separate estimates showed errors greater than 10 percent; in bluegills, where errors of estimate were highest, 78 percent showed errors greater than 10 percent. Only among yellow perch were marked fish commonly recaptured in proportions less than their true abundance in the population. This resulted in more overestimations than underestimations for perch. In all other species, underestimations exceeded overestimations because of the recapture of disproportionately large numbers of marked fish. These data were believed to indicate that marking did not influence catchability. The cause of bias possibly differed with different species and was never completely assignable; however, bias may have been caused (1) by the greater susceptibility to capture of certain segments of populations, or (2) by the existence of certain groups of fishes living in areas of high vulnerability to which they returned when marked and released. The variable quality of the estimates based on data collected by seining demonstrates that such estimates may be unreliable. (Authors)

7887. Mason, Charles P. (Dept. of Biology, Hamline University, St. Paul, Minnesota). 1965. ECOLOGY OF CLADOPHORA IN FARM PONDS. Ecology, 46(4): 421-429.

The ecology of Cladophora glomerata (L.) Kützing was studied in five farm ponds near Ithaca, New York, in comparison with a control pond in which the alga was absent. Periodic samples and observations were taken over a 14-month period for temperature, pH, light penetration, water level (including ice and snow cover), nitrate, phosphate, BOD, plankton (counts and identity), and condition of Cladophora glomerata. C. glomerata was found to live throughout the year in the vegetative condition. In the pond which contained the most C. glomerata, akinetes occurred in abundance throughout the year except in May when a large percentage of them germinated. Approximately 5 percent of the overwintering vegetative cells in that pond also released zoospores during May and the first half of June. Filaments which overwintered on the bottom began rising to the surface in mid-May, and their vegetative growth during late June and early July caused the greatest increase of the alga. Increase in mass of the alga from germinating akinetes and zoospores was minor compared with vegetative increase from overwintered filaments. Temperature, pH, and phosphate concentration were not directly related to C. glomerata productivity. Amount of light did not limit the abundance of the alga, but decrease in amount of light may initiate akinete and zoospore formation. Plankton counts in the six ponds indicate that each has approximately the same total productivity. High productivity of C. glomerata was directly associated with high nitrate and high biochemical oxygen demand. (Auth.)

7888. Hevesy, G., D. Lockner, and K. Sletten. (Inst. Organ. Chem. and Biochem., Univ. Stockholm, Stockholm, Sweden). 1964. IRON METABOLISM AND ERYTHROCYTE FORMATION IN FISH. Acta Physiol Scand., 60(3): 256-266. Illus.; Biological Abstracts, Vol. 45, No. 16, Abst. No. 68328. 1964.

Iron metabolism in tench was studied. At 18° up to 70 percent of injected Fe^{59} was taken up by the erythrocytes. In the first days of the experiment an appreciable part, up to 20 percent, of the Fe^{59} is present in the erythrocytes as nonhemoglobin iron, the latter decreases with time. Hemoglobin (Hb) concentration amounted to 5.4 g%, erythrocyte number 1.04×10^6 per mm^3. Serum iron was found to be 61 γ g% and iron binding capacity 250 γ g%. Plasma iron half disappearance rate is 4 hours. In fish kept at 5° iron taken up by erythrocytes amounts to 4 percent only. Both in at 18° and 5° kept fish one Hb fraction and one transferrin fraction was found only. At high oxygen concentration or in nitrogen atmosphere less Fe^{59} is incorporated in in vitro experiments into erythrocyte hemin than in air. The life time of about 60 percent of erythrocytes amounts to about 150 days at 18°, indications of longer-living erythrocytes were found. (Authors)

7889. Masai, Hideo (Yokohama Univ. Sch. Med., Yokohama, Japan), and Shozo Matano. 1962. COMPARATIVE NEUROLOGICAL STUDIES ON THE GLYCOGEN DISTRIBUTION IN THE CENTRAL NERVOUS SYSTEM OF TAILED AMPHIBIANS AND SHARKS. Yokohama Med. Bull., 13(4): 259-264. Illus.; Biological Abstracts, Vol. 45, No. 16, Abst. No. 69496. 1964.

The glycogen distribution in the central nervous system of tailed amphibians (Triturus and Onychodactylus) and shark (Scoliodon) was studied with the lead-tetra-acetate-Schiff method. In tailed amphibia in January, the glycogen granules are intensely accumulated in the neuropil and within nerve cells throughout the entire parts of central nervous system. The following areas show a relatively intense glycogen reaction—glomerula olfactoria, primordium hippocampi, pars septalis, nucl. habenulae, nucl. geniculatus lateralis, basal optic nucleus, nucl. interpeduncularis, tectum opticum, acoustio-lateral area, nucl. tractus spinalis n. V and substantia gelatinosa of the posterior horn. As to Triturus, the glycogen reaction is generally decreased in July. The glycogen deposition of the chorioid plexus, ependyma and paraventricular structure changes hardly with the season. The gray substance in the mesencephalon, rhombencephalon and spinal cord tends to possess more intense glycogen deposition than that in the diencephalon and telencephalon. The brain tissue of Scoliodon represents a faint glycogen reaction, excepting the chorioid plexus, ependyma and paraventricular structure. (Authors)

7890. Templeman, Wilfred (Fish. Res. Bd. Canada, Biol. Sta., St. John's, Newfoundland). 1964. DISTRIBUTION OF SHARKS IN THE CANADIAN ATLANTIC WITH SPECIAL REFERENCE TO NEWFOUNDLAND WATERS. Bull. Fish. Res. Bd. Canada, 140. 1-77. Illus. Maps.; Biological Abstracts, Vol. 45, No. 16, Abst. No. 71328. 1964.

This Bulletin attempts to bring together all authenticated published records and as far as possible to list new records and discuss the distribution in the Canadian area of sharks occurring in the Newfoundland area. Alopias vulpinus and Carcharodon carcharias are occasional summer visitors. Cetorhinus maximus was formerly usually scarce or absent in the western Gulf of St. Lawrence and in northeastern Newfoundland waters but now is not uncommon in summer as far west and north as the Gaspé Peninsula and occasionally present as far east and north as Fogo Island. The Newfoundland specimens are usually large. Lamna nasus is common and present in commercial quantities in the southern part of the Newfoundland area and on the Newfoundland banks in summer and some adults including females with young are present on southwestern Grand Bank in winter. Three separate captures of egg cases tentatively identified as Apristurus profundorum extend the known range of this species, previously recorded northward to the southwestern Scotian Shelf, to the southwestern Grand Bank. Prionace glauca is found and is probably common in August-September on the southern part of the Newfoundland area. Centroscyllium fabricii is relatively common from mainly below 250 fathoms (460 m) on the continental slope of the whole Canadian area as far northward as 65°12'N, 58°13'W. Etmopterus princeps occurs on the continental slope off southern Nova Scotia but has not yet been found in the Newfoundland area. Centroscymnus coelolepis, formerly found and thought to be moderately plentiful on the southwestern slope of the Grand Bank and on the seaward slope of the one new record (from the Scotian Shelf) during the past 80 years. Somniosus microcephalus is common in many parts of the eastern Arctic and as far southward as northeastern Newfoundland in winter. Southward of this and in summer it is commonest on the eastern slope of the Northeast Newfoundland Shelf. Further southward occasional specimens are caught usually on seaward slopes of the banks and from the western part of the Gulf of St. Lawrence and there are many records as far southward as the Gulf of Maine. Squalus acanthias occurs in large numbers in summer and autumn on the south coast of Newfoundland and in late spring to early summer in moderate numbers on southwestern Grand Bank and in great numbers on northwestern St. Pierre Bank. These dogfish migrate northward around the whole coast of Newfoundland and occasionally to southern Labrador in numbers varying greatly with the years. The young are not born in the Newfoundland area, as the pregnant females migrate back to the United States area in late autumn and liberate their young before returning northward. Some smaller spiny dogfish remain overwinter in the Newfoundland area and are occasionally killed by cold water. (Auth.)

7891. Kozhov, M. M. 1962. DIURNAL RHYTHMS IN THE BEHAVIOR OF PELAGIC ANIMALS IN LAKE BAIKAL. (O SUTOCHNYKH RITMAKH V POVEDENII PELAGICHESKIKH ZHIVOTNYKH OZ. BAIKAL.) In: Problemy zoologicheskikh issledovanii v Sibirii. (Problems of zoological research in

Siberia). Gorno-Altaisk. 121-124.; Referat. Zhur., Biol., 1963, No. 7D237. (Translation). Biological Abstracts, Vol. 45, No. 16, Abst. No. 67339. 1964.

Seasonal dynamics in the diurnal vertical migrations of Epischura baicalensis and the diurnal rhythm of feeding of plankton-eating fish (Coregonus autumnalis migratorius) are briefly described. The results of observations on the behavior and diet of the Baikal omul (C. autumnalis) in the reservoirs are also described. The theory of protective-adaptive importance of diurnal vertical migrations of zooplankton is concisely stated.

7892. Krumholz, Louis A. (Univ. Louisville, Louisville, Ky.). 1963. RELATIONSHIPS BETWEEN FERTILITY, SEX RATIO AND EXPOSURE TO PREDATION IN POPULATIONS OF THE MOSQUITOFISH GAMBUSIA MANNI HUBBS AT BIMINI, BAHAMAS. Internatl Rev. Ges. Hydrobiol. 48(2): 201-256. Biological Abstracts, Vol. 45, No. 16, Abst. No. 67423, 1964.

Two populations of Gambusia manni were sampled. One population was from a natural mangrove pool, and one from a man-made pool, the former with predator fish, and the latter without. It was determined that in both populations females continue to grow throughout life, and that the males cease growth after the development of the gonopodium. Criteria of sexual maturity are described. Fish from the natural pool attained maturity at smaller sizes than those in the artificial pool. Fish not subjected to predation had lower fertility compared to those subject to predation. Fish from the natural pool were eliminated by predation before reaching senility, whereas a large percentage of those from the artificial pond attained senility. There were always more females than males in the natural pool, but the sexes were approximately equal in the artificial one. --C. C. Davis.

7893. Minoranskii, V. A. (State Univ., Rostov-on-the-Don, USSR). 1963. LAKE MANYCH-GUDILO (MANYCH-BUDILO). Priroda, 52(4): 75-80. Illus. Biological Abstracts, Vol. 45, No. 16, Abst. No. 67462. 1964.

Some peculiarities of this former salt lake are described. (It was once part of the single water basin that today is divided into the Black, Caspian, and Aral Seas.) Because of the construction of the Nevinnomysskii Canal, freshwater from the Kuban passed into the Bol'shoi Egorlyk River, then into the Manych River, gradually turning Manych-Gudilo into a fresh-water lake. Now the lake is filled with water throughout the year and changes have occurred in the flora and fauna. Hardy vegetation began to develop on small inlets and along low shores. In the plankton there was an increase in the number of Cladocera and copepods. The benthos now consists chiefly of Chironomidae larvae and various microorganisms. After a few years new species of fish emigrated from the Don (carp, zander, roach, ide, sea-roach, perch, and others). Changes occurring in the species composition of birds after the introduction of fresh water are described. -- M. Das.

7894. Avdos'yev, B. A., and N. E. Voznyi. (Fish Breeding Exptl. Sta., L'vov, USSR). 1963. ELIMINATION OF DACTYLOGYROSIS FROM REARING PONDS (LIKVIDATSIYA DAKTILOGIROZA V VYRASTNOM PRUDU). Veterinariya 40(8): 55-56. Illus.; Biological Abstracts, Vol. 45, No. 16, Abst. No. 67492. 1964.

In some fish-rearing ponds in the Western Ukraine, outbreaks of dactylogyrosis occur every year. The following method of treatment was developed. A 3 x 5 m wooden frame in the shape of a triangular prism was placed within a canvas enclosure located near the spot where the fish were fed. The frame was covered with gauze. A clearance was left between the bottom of the pond and the lower edge of the open canvas enclosure, so that the fish could swim under the enclosure to the place where they were fed. A glass vessel containing 4 liters of 25 % ammonia in which 20 g of $CuSO_4$ had been dissolved was fastened above the enclosure. The solution from the glass vessel was allowed to flow slowly through a rubber tube into the middle of the space enclosed by the gauze. The flow through the rubber tube was regulated by means of a clamp. An arrangement of this type was installed in every hectare of the pond area. The treatment of fish was carried out for 7 days in the mornings, while the fish were being fed. During the treatment, a concentration of 25-50 mg/l of ammonia and of 0.4-0.5 mg/l of $CuSO_4$ was established in the water of the pond. This treatment eliminated dactylogyrosis in one pond, while up to 55% of carp fry died in a control pond in which the treatment was not applied. --L. M. Blumenthal.

7895. Isaev, A. 1963. ACCLIMATIZATION OF FISH IN WATERS OF THE SOVIET UNION (AKKLIMATIZATSIYA RYB V VODOEMAKH SOVETSKOVO SOYUZA). Rybovodstvo I Rybolovstvo 6(2): 7-10. Illus. Maps.; Biological Abstracts, Vol. 45, No. 16, Abst. No. 67503. 1964.

In the Soviet Union, acclimatization of fish is increasing. In the past 2 years 400 transplantations were made: 157 bodies of water received 74 species of valuable commercial fish. Transplants were made of 500,000 spawners and adults of various ages; 76 million juveniles; 133 million fry and larvae; and 63 million fertilized eggs. Some fish were imported. In 1960-1962, about 26 million eel larvae were imported from France and England for rearing until marketable weight was reached. Over 4.5 million plant-feeding juvenile grass and silver carp were brought in from China, and over 1.5 million rainbow trout eggs from Czechoslovakia. In rail transportation, live-fish cars were used in which the required temperature and oxygen conditions were maintained. Fertilized roe were transported in foam-plastic containers. The thermal insulation of the plastic permitted air transport to be used. In the containers the eggs are kept on gauze or metal net frames. Ice is placed on an upper frame. For transporting juveniles, rectangular plexiglass boxes 50 cm long, 30 cm wide, and 30 cm high are utilized. The water is aerated with compressed air. Inner tubes may also be used. Polyethylene bags are widely used. They

are filled with water and charged with oxygen. Fish and other aquatic animals may be transported over great distances in polyethylene bags without changing the water. Successful results have been obtained in acclimatizing "Black-sea mullet" in the Caspian Sea. Caspian sturgeon and Baltic herring have adapted fairly well to the Aral Sea; kutum to the Azov Sea; goldfish to the reservoirs of Kamchatka, where yearly they yield over 300 tons; zander to the reservoirs of Karelia, the Urals, and to the Novosibirsk Reservoir; bream to Ubin Lake, the Irkutsk, the Novosibirsk Reservoirs; carp and zander to Balkhash Lake; pink salmon to the basin of the Barents and White Seas; and Lake Ladoga cisco to the Ural lakes. In the southern regions of the USSR, fish-rearing establishments will be created for mass breeding of plant-eating fish (silver and grass carp). They are to be grown in ponds, reservoirs of hydroelectric power stations, irrigation canals, lakes becoming overgrown with weeds, and rivers. Transplantation of food organisms and other aquatic and plants will be expanded. --D. E. Bevan.

7896. Loshakov, A. S. (Pedinst., Melitopol', USSR.). 1963. THE FISHFAUNA OF THE BERDA AND OBITOCHNAYA RIVERS. (IKHTIOFAUNA REK BERDY I OBITOCHNOI.) Vopr Ikhtiol 3(2): 235-242; Biological Abstracts, Vol. 45, No. 16, Abst. No. 67509. 1964.

The Berda and Obitochnaya Rivers, emptying into the Sea of Azov, are inhabited by a large number of fish, 48% of which are cyprinids. A list of species and remarks on relative numbers, breeding biology and ecology, are presented. There are up to 37 fish per square meter. Of the 44 Berda and 39 Obitochnaya species, 20 and 18, respectively, are freshwater forms. There are two distinct forms of carp, the partially anadramous and the non-migratory. Because of heavy catches by sport fishermen during periods of schooling, the valuable economic fishes (eg. roach, carp, etc.) must be further protected during migration and on the breeding grounds. Also, collective and state farms should be prevented from building dams without first securing consent from the state fish inspectorate. Bibliography with 10 references. --L. T. Penny.

7897. Sprague, J. B. (Fish. Res. Bd., St. Andrews, New Brunswick, Canada.), and W. V. Carson. 1964. CHANGES IN MINING POLLUTION OF THE NORTHWEST MIRAMICHI RIVER FROM JUNE 30, 1960 TO THE END OF 1963. Fish. Res. Bd. Canada Gen. Ser. Circ. 42. 1-4. Illus.; Biological Abstracts, Vol. 45, No. 16, Abst. No. 67515. 1964.

Degree of pollution is designated as percentage of incipient lethal level. At 100, by definition, pollution is on the border line of killing young salmon. At scores higher than 35 to 45 migrating salmon are impeded in spawning migration. In 1960 the start of pumping operations in an old zinc-copper mine shaft put scores in the Northwest Miramichi River, New Brunswick, Canada, to an average of 77. In subsequent years following treatment scores averaged 24, 49, and 67. --J. L. Hart.

7898. Strekalova, I. I. 1963. OBSERVATIONS ON SPAWNING OF PINK SALMON ONCORHYNCHUS GORBUSCHA (WALBAUM) AND CHUM SALMON ONCORHYNCHUS KETA (WALBAUM) IN THE MY RIVER (AMUR ESTUARY). (NABLYUDENIYA ZA NERESTOM GORBUSHI ONCORHYNCHUS GORBUSHA (WALBAUM) I LETNEI KETY ONCORHYNCHUS KETA (WALBAUM) V REKE MY (LIMAN AMURA). Vopr Ikhtiol, 3(2): 256-265. Illus.; Biological Abstracts, Vol. 45, No. 16, Abst. No. 67517. 1964.

The main breeding grounds of pink salmon in the My River are usually in the upper parts of the river, while those of the summer chums are in the middle and lower parts of the river. However, pink salmon entering the river later in the season tend to breed in the latter two areas, while a part of the chum population breeds in the upper region alongside pink salmon, especially when the population entering the river is large. The redds of pink salmon tend to be constructed in more swiftly flowing areas (0.6-1.4 m/sec) and more nearly in the center of the stream, than those of chums (0.2-1.0 m/sec). In chum, each female is accompanied by 1-2 males during nest preparation and breeding, whereas in pink, each breeding female is accompanied by 4-10 males. Actual breeding occurs at night. Following oviposition, female chum remain to guard the nests 1-6 days (averaging 3-4), while female pinks guard their nests only 1-2 days. This disparity in duration of "guarding" is in part attributed to the pink salmon having their nests in more swiftly flowing waters, necessitating a greater expenditure of energy in maintaining their geographical position in the stream. In 1952 the average number of eggs in a summer chum redd was 1639 (or 64.2% of the average absolute fecundity), while the mortality was 2.8%. The average number of eggs in a pink salmon redd was 1025 (or 57% of the average absolute fecundity), while the mortality was 1.7%. In 1951 there were on the average 780 eggs (33.1% av. absolute fecundity) per chum redd and 734 eggs (41% av. absolute fecundity) per pink salmon redd. The egg mortality in both species was much higher than in 1952, due to silting and flooding. Pink salmon, breeding in swifter waters, lose more eggs during oviposition than chum, but their eggs have a lower mortality since the more rapid flow provides the eggs with better developmental conditions (less silting, higher 0_2 tension, etc.) Bibliography with 10 references. --L. T. Penny.

7899. Tugarina, P. Ya., and T. A. Khodareva. 1963. THE FOOD COEFFICIENT AND DAILY RATION OF FINGERLING GRAYLING THYMALLUS ARCTICUS BAICALENSIS DYB. (KORMOVOI KOEFFITSIENT I SUTOCHNYI RATSION MAL'KOV CHERNOGO KHARIUSA THYMALLUS ARCTICUS BAICALENSIS DYB.). Vopr. Ikhtiol., 3(2): 414-416.; Biological Abstracts, Vol. 45, No. 16, Abst. No. 67518. 1964.

Groups of grayling fry resulting from the artificial fertilization of eggs obtained from females from two different Baikal Rivers were kept in

aquariums at 2 different temperatures (14.4 and 15.3° C.) and given different daily food rations of (90-100, 45-50, 25-20, and 10% of the fry weight) per day. The greatest daily food ration consumed was 60% of the fry weight. Significant weight gains resulted from a daily ration of consumed food of 15-25% of the fry weight or greater. Fry consuming less than 10% of their weight in food daily gained only insignificantly or died. The optimal food or nutritional coefficients were found to be 4.8 for fry from Angara River females and 3.9 for those from Goloustnaya River females. Bibliography with 5 references. --L. T. Penny.

7900. Volodin, V. M. (Inst. Biol. Internal Waters, Acad. Sci. USSR, Borok, USSR.). 1963. FECUNDITY OF THE ROACH RUTILUS RUTILUS (L.) IN THE RYBINSK RESERVOIR. (PLODOVITOST' PLOTCY RUTILUS RUTILUS (L.) V RYBINSKOM VODOKHRANILISHCHE). Vopr Ikhtiol, 3(2): 266-274.; Biological Abstracts, Vol. 45, No. 16, Abst. No. 67519. 1964.

In 1960-61 117 female roaches in the 4th stage of gonadal development from Rybinsk Reservoir were examined. It was found that the absolute fecundity was linearly related to body weight, body length and age. Good nutrition produces higher absolute and relative fecundity. Both absolute and relative fecundity had increased markedly since 1953, presumably because of increased growth rates for the past year. In a population of several age groups fecundities may be estimated for past years by knowing the age at which a fish becomes sexually mature and the average lengths of each age group for past years (from scale analysis), and applying a fecundity-length relationship. Bibliography with 18 references. --L. T. Penny.

7901. Wolf, Robert S. (U.S. Bur. Comm. Fish., La Jolla, Calif.). 1964. OBSERVATIONS ON SPAWNING PACIFIC SARDINES. Calif. Fish and Game, 50(1): 53-57.; Biological Abstracts, Vol. 45, No. 16, Abst. No. 67520. 1964.

In Mexican waters on the night of August 16, 1958, scientists aboard the U.S. Bureau of Commercial Fisheries research vessel, Black Douglas, observed unfamiliar behavior by a school of Pacific sardines, Sardinops caeruleus. The behavior is described in comparison with known behavior patterns of the fish. A collection was made using hook and line and gill net. The fish were in ripe spawning condition and constituted the largest collection of spawning sardines taken to date. Fish of this collection were larger and older than fish normally taken by the commercial sardine fishery of the area. Other samplings of spawning sardines are noted. Surface and subsurface collections of pelagic sardine eggs were made with a one-meter plankton net concurrently with the fish collection. Determinations of developmental stages of these eggs confirm that sardines actually spawn somewhat below the water's surface. Ova diameter measurements at various ages compare favorably with like measurements of other investigators. Although the behavior described occurred simultaneously with spawning, actual spawning was not observed and any link between the two is only inferred. --Author

7902. Yukhimenko, S. S. (Amur Div. Pac. Res. Inst. Mar. Fish. and Oceanog., Khabarovsk, USSR). 1963. THE FOOD OF THE AMUR STURGEON ACIPENSER SCHRENCKI BRANDT AND THE KALUGA HUSO DAURICUS (GEORGI) IN THE LOWER AMUR RIVER. (PITANIE AMURSKOGO OSETRA ACIPENSER SCHRENCKI BRANDT I KALUGI HUSO DAURICUS (GEORGI) V NIZHNEM TECHENII AMURA). Vopr Ikhtiol, 3(2): 311-318.; Biological Abstracts, Vol. 45, No. 16, Abst. No. 67522. 1964.

The food contents of the entire digestive tracts of 71 Amur sturgeons (53.3-131 cm) and 15 young kaluga (46.5-117 cm), collected in 1957 and 1959, were analyzed. Trichopteran larvae were the most important food (78.25-98.94%) of the Amur sturgeon, while crustaceans, chironomid larvae and mollusks of secondary importance. At no time during the ice-free season were sturgeons with empty stomachs found. The index of Fullness for Amur sturgeons averaged 70 (65.6 in June to 140.9 in Sept.), being 10,000 times ratio of the dry weight of food in the digestive tract to dry body weight (less viscera). Feeding is chiefly random with both young and old Amur sturgeons having nearly identical diets. The food habits of the Amur sturgeon are practically identical to those of the Siberian sturgeon Acipenser baeri of the Lena and Yenisei Rivers. Conversely, young kaluga feed chiefly on small, non-economic fishes: gudgeon (Gobio sp.), Amur ide (Leuciscus waleckii), Amur barbel (Hemibarbus sp.), banded catfish (Pseudobagrus fulvidraco) and young Arctic lampreys (Lampetra japonica). Crustaceans, especially shrimps, were a secondary, but limited, foot item. In Kaluga the index of fullness varied from 10 to 720. --L. T. Penny.

7903. Zhuravel', P. A. 1963. PROSPECTS FOR INTRODUCING THE ESTUARINE DECAPOD CRUSTACEANS NOW ESTABLISHED IN CRIMEAN RESERVOIRS INTO OTHER USSR RESERVOIRS. (PERSPEKTIVY VSELENIYA AKKLIMATIZIROVANNYKH V VODOKHRANILISHCHAKH KRYMA LIMANNYKH VYSSHIKH RAKOOBRAZNYKH V DRUGIE VODOKHRANILISHCHA SSSR). In: Materialy po biologii i gidrologii volzhskikh vodokhranilishch. (Data on the biology and hydrology of Volga reservoirs). Akad. Nauk SSSR: Moscow-Leningrad. 23-24. 1963; Referat. Zhur., Biol., 1963, No. 10D128. (Translation); Biological Abstracts, Vol. 45, No. 16, Abst. No. 67523. 1964.

In 1959-1960 the following species were settled in the Simferopol'sk and Chernorechensk reservoirs: Pontogammarus maeoticus, Chaetogammarus varpachowskyi, Pseudocuma cercaroides, Hemimysis anomala, and others. Introduced previously were Dikerogammarus haemobaphes, Ch. tenellus, Limnomysis benedeni, Mesomysis kowalewskyi and M. intermedia. All the species indicated became well established. Gammarids and mysids which had been established in

Simferopol'sk reservoir were transferred to other reservoirs of the Crimea and also to reservoirs far beyond its boundaries (Belogorsk, Chernorechensk in the Crimea, to Kaunas reservoir on the river Neman, and to Krasnooskol'sk on the Oskol river in Khar'kov oblast). In all cases the introduced gammarids and mysids quickly adapted themselves and became part of the diet of the commercial fish.

7904. Bilinski, E., and R. E. E. Jonas. (Technol. Res. Lab., Fish. Res. Bd. Canada, Vancouver, British Columbia, Canada). 1964. UTILIZATION OF LIPIDS BY FISH. 2. FATTY ACID OXIDATION BY A PARTICULATE FRACTION FROM LATERAL LINE MUSCLE. Canadian Jour. Biochem., 42(3): 345-352. Illus.; Biological Abstracts, Vol. 45, No. 16, Abst. No. 67923. 1964.

The fatty acid oxidizing system present in lateral line muscle of rainbow trout (Salmo gairdneri) and sockeye salmon (Oncorhynchus nerka) was studied by using subcellular particles, having the sedimentation characteristics of mitochondria. The rate of oxidation of K-myristate-1-C^{14}, and Na-hexanoate-1-C^{14} was determined at 25° C. by measuring the formation of $C^{14}O_2$. Oxidation was stimulated by adenosine triphosphate Mg++, coenzyme A and tricarboxylic acid cycle intermediates, but not by cytochrome c. It was optimum at pH 7.5-8.5. The data are consistent with the assumption that in the lateral line muscle fatty acid oxidation takes place through the known mechanism involving CoA derivatives. (Authors)

7905. Faktorovich, K. A. 1958. ON FAT METABOLISM DISTURBANCES IN RAINBOW TROUT (SALMO GAIRDNERI) LIVER RAISED ON ARTIFICIAL FEED. (O NARUSHENII ZHIROVOGO OBMENA V PECHENI RADUZHNOI FORELI PRI VYRASHCHIVANII NA ISSKUSTVENYKH KORMAKH). Tr. Soveshch Ikhtiol. Komis. Akad. Nauk. SSSR 8. 237-243.; Referat. Zhur., Biol., 1959, No. 39916. (Translation).; Biological Abstracts, Vol. 45, No. 16, Abst. No. 67926. 1964.

Disturbances of the fat metabolism as a fat dystrophy of the liver was often noticed in rainbow trout raised on artificial food. Granules of sudanophilic substance insoluble in organic solvents are being accumulated together with an increase in the quantity of fat in the trout's hepatic cells under feeding with aliments poor in vitamins and of lower quality. This substance, by accumulation destroys the hepatic cells inducing the degeneration of the organ and the death of the fish. Transfer of fish in time to a full value alimentation may produce a regeneration of the liver and recovery. The regeneration process occurs because of the direct nuclear division preserved in the hepatic cells. The symplasts formed then split into cellular territories and form typical hepatic proteins. Together with the architectonics restoration of the liver, a delivery of the sudanophil insoluble substance takes place. This process occurs because of active phagocytosis and the conversion of the insoluble substance into a soluble one as a result of changes in diet.

--Courtesy NSF (PL 83-480) 1963.

7906. Orska, Janina. (Zool. Inst., Wroclaw Univ., Wroclaw, Poland.) 1962. THE INFLUENCE OF TEMPERATURE ON THE DEVELOPMENT OF MERISTIC CHARACTERS OF THE SKELETON IN SALMONIDAE. I. TEMPERATURE-CONTROLLED VARIATIONS OF THE NUMBER OF VERTEBRAE IN SALMO IRIDEUS GIBB. Zool. Polon., 12(3): 309-399. Illus. (Recd. 1963). (Polish and Russian summ.); Biological Abstracts, Vol. 45, No. 16, Abst. No. 69295. 1964.

Spawn of the rainbow trout (Salmo irideus Gibb.) has been subjected to considerable changes in temperature to study the effect on the number of vertebrae in the young fish. The aim of these experiments has been to find the periods of sensitivity of the embryo. Changes in temperature (warm treatment and cold treatment) were applied for only a short time (no longer than 18 D°) and at very short intervals: every 13, or every 8 day-degrees. The existence of a period of high sensitivity discovered by Taning in the sea trout Salmo trutta trutta L. and labelled by him the "super-sensitive period" has been fully confirmed. Certain conclusions have been reached with regard to the character of the stimulus: variations in the number of vertebrae are due not so much to rapid change in temperature, as claimed by Taning, but to its level in a given developmental stage. However, certain stimulating effects of the change are likely and special investigations are intended on this subject. Temperature modifies not the number of vertebrae immediately, but the number of somites, with which the number of vertebrae is closely connected; at the same time it modifies their size: in principle lower temperature causes more and somewhat smaller somites to form in a given section, while at higher temperature the somites of a given section gain in mass and decrease in number, hence the differences in the number of vertebrae. This correlation exists throughout gastrulation and segmentation of the embryo. Only during blastopore closing and tail bud formation a converse correlation comes into operation (increase in the number of somites at higher, decrease at lower temperature). It consists, like in the former case, in a modifying influence of temperature on the number and size of somites. (Auth.)

7907. Ignat'eva, G. M. 1963. A COMPARISON OF THE DYNAMICS OF THE INVAGINATION PROCESS OF CHORDAMESODERM MATERIAL IN EMBRYOS OF ACIPENSER CHYPA, A. GULDENSTADTI AND AMBLYSTOMA. (SRAVNENIE DINAMIKI PROTSESSA INVAGINATSII MATERIALA KHORDOMEZODERMY U ZARODYSHEI SEVRYUGI, OSETRA I AKSOLOTLYA). Dokl. Akad. Nauk. SSSR., 151(6): 1466-1469. Illus.; Biological Abstracts, Vol. 45, No. 16, Abst. No. 69404. 1964.

A recently suggested, non-dimensional descriptive method (Detlaf, T. A. and A. A. Detlaf, DAN 134, 199 (1960)) permits comparison of the same processes of embryogenesis in various animals; it uses as unit the duration of a delimited developmental period, reflecting the developmental rate of the species and dependency upon exterior conditions.

This method was used for studying the gastrulation period in 2 species of fish and one amphibian at constant temperature. Signs of beginning and end of this period in the egg (pigmentation of the future dorsal lip of the blastopore and slot-like blastopore respectively), manner and number of fixations, sections and test conditions are described. Invagination dynamics was determined by measuring the arc occupied by the material during this motion, expressed in radial angles, and taking the initial position of the dorsal lip as reference point. A total of 604 embryos were dissected and measured (10/ fixation period). Results show that about 1/5 of the initial gastrulation period was taken up by preparatory cellular changes at the dorsal lip. Invagination rate was constant in the fish, motion similar in both species. In the amphibian this rate varied; during the first half it was double that of the fish embryo rate, slowing down during the second half to about 1-1/3 that rate. However, the position of the chorda-mesoderm at the end of gastrulation in respect to the animal-vegetal axis of the embryo at its beginning was the same in all 3 species (56 to 58.5°). Angle values are reported and the corresponding linear values graphed. Values obtained by fixation agreed satisfactorily with those obtained from living embryos.--E. Engle.

7908. Konstantinov, K. G. 1957. A STUDY OF THE COMPARATIVE MORPHOLOGY AND BIOLOGY OF THE PERCH, THE PIKE-PERCH, AND THE VOLGA PERCH-PIKE IN VARIOUS STAGES OF DEVELOPMENT. (SRAVNITEL'NYI ANALIZ MORFOLOGII I BIOLOGII OKUNYA, SUDAKA I BERSHA NA RAZNYKH ETAPAKH RAZVITIYA). Tr. Inst. Morfol. Zhivotnykh Akad. Nauk SSSR 16. 181-236. 1957; Referat. Zhur., Biol., 1959, No. 74296. (Translation); Biological Abstracts, Vol. 45, No. 16; Abst. No. 69464. 1964.

The postembryonic development of the perch (Perca), the pike-perch (Lucioperca lucioperca), and the Volga pike-perch (Lucioperca volgensis) collected during 1947-1949 in the delta of the Volga, in the rivers Manych, Don and Koisug has been studied. A number of perch were also received from the Glubokoe Lake of the Moscow oblast'. In the development of the first two species 11 stages were observed, whereas in the development of the Volga pike-perch (described for the first time) 4 stages were stated. Each stage of the species was characterized by constant measurements, definite morphological features, mode of behavior and activity (this determines the interrelation between the fish and environment). The passage from stage to stage occurred as a result of abrupt changes in the morpho-physiological complex of features. Similar stages were evident in the development of all 3 species, along with specific peculiarities. The differences between the pike-perch and the perch were especially obvious in the 10th and 11th stages, when the pike-perch acquired the organization of a typical predator. The perch preserved the similarity with the ancestral form to a greater extent than the other two; the Volga pike-perch has an intermediate position. It is assumed that the divergence from the ancestral form took two directions: one leading to the present perch, and the other to the Volga pike-perch and the pike-perch. The perch diverged more from the original from than the Volga pike-perch and the pike-perch in the way of oviposition. The egg ribbon of the perch is suspended in the upper layers of the water, which assures its development at any conditions of the bottom; this facilitates the wide dispersal of this species. The "nest" of the pike-perch is built by the male, who protects it against enemies and from being covered by silt. The developmental stages of the studied species cannot as yet be related to those of the cyprinids, although certain developmental features are common to both.

--Courtesy NSF (PL 83-480) 1963.

7909. Collette, Bruce B. (Bur. Commercial Fish., U.S. Natl. Mus., Washington, D.C.), and Robert H. Gibbs, Jr. 1962. A PRELIMINARY REVIEW OF THE FISHES OF THE FAMILY SCOMBRIDAE. In: Proceedings of the World Scientific Meeting on the Biology of tunas and related species, La Jolla, California,; FAO Fish Repts., 3(6): 977-978. 1963. (French and Spanish summ.); Biological Abstracts, Vol. 45, No. 16, Abst. No. 71299. 1964.

Tentatively, two subfamilies are recognized within the Scombridae: the Gasterochismatinae (which may perhaps have to be split off as a separate family) and the Scombrinae. Within the latter there are two major groups of genera, the more primitive ones (Scomber to Acanthocybium) which lack a bony caudal notch and the more advanced (Gymnosarda to Thunnus) which have a bony caudal keel and lack a caudal notch. Both these groups can be further split into smaller groups of genera: Scomber (about 2 species) and Rastrelliger (1 or 2 species); Scomberomorus (9 to 15 species) and the monotypic Grammatorcynum and Acanthocybium; Gymnosarda (1 or 2 species) and the monotypic Orcynopsis; Sarda (2 to 5 species); Auxis (probably 2 species); Euthynnus (2 to 5 species); the monotypic Allothunnus; and Thunnus (6 species).(Authors)

7910. Fitch, John E., and Phil M. Roedel. (Resources Agency Calif., Dept. Fish and Game, Terminal Island, Calif.). 1962. A REVIEW OF THE FRIGATE MACKERELS (GENUS AUXIS) OF THE WORLD. In: Proceedings of the World Scientific Meeting on the Biology of tunas and related species, La Jolla, California. FAO Fish Reports, 3(6): 1329-1342. Illus. 1963. (French and Spanish summ.); Biological Abstracts, Vol. 45, No. 16, Abst. No. 71301. 1964.

Based upon an examination of 147 adult Auxis from many localities, primarily north of the equator, it was concluded there are two valid species. Auxis thazard, a narrow-corseleted species with thin, oblique, wavy markings on the back is confined to the Pacific, but Auxis rochei, which has a wide corselet of scales and a pattern of broad, nearly vertical dark bars, is cosmopolitan in distribution. No one has yet found a means of identifying larval, post-larval or juvenile Auxis to species because the distinguishing corselet and dorsal markings are not developed until these fish are about 200 mm long. (Auth.)

7911. Jones, S., and E. G. Silas (Centr. Mar. Fish. Res. Inst., Mandapam Camp, India). 1962. TUNA AND TUNA-LIKE FISHES FROM THE INDIAN SEAS. In: Proceedings of the World Scientific Meeting on the Biology of tunas and related species, La Jolla, California,; FAO Fish Repts., 3(6): 1775-1796. Illus. 1963. (French and Spanish summ.); Biological Abstracts, Vol. 45, No. 16, Abst. No. 71306. 1964.

An account of the tuna and tuna-like species from the Indian Ocean and contiguous seas is given along with a tentative key for their identification. Regional references for each species and subspecies, as well as pertinent synonyms are included. The species and subspecies dealt with are: Grammatorcynus bicarinatus (Quoy and Gaimard); Auxis thazard (Lacepede); Auxis thynnoides Bleeker; Cybiosarda elegans Whitley; Sarda orientalis (Temminck and Schlegel); Gymnosarda unicolor (Ruppell); Thunnus (T.) thynnus orientalis (Temminck and Schlegel); Thunnus (T.) alalunga (Bonnaterre); Thunnus (Parathunnus) obesus sibi (Temminck and Schlegel); Kishinoella tonggol (Bleeker); Thunnus (Neothunnus) albacares macropterus (Temminck and Schlegel); Thunnus (Neothunnus?) itosibi Jourdan and Evermann; Allothunnus fallai Serventy; Katsuwonus pleamis (Linnaeus); and Euthynnus affinis affinis (Cantor). (Authors)

7912. Mather, Frank J. (Woods Hole Oceanog. Inst., Woods Hole, Mass.). 1962. TUNAS (GENUS THUNNUS) OF THE WESTERN NORTH ATLANTIC. II. DESCRIPTION, COMPARISON AND IDENTIFICATION OF SPECIES OF THUNNUS BASED ON EXTERNAL CHARACTERS. In: Proceedings of the World Scientific Meeting on the Biology of tunas and related species, La Jolla, California.; FAO Fish Repts., 3(6): 1155-1157. 1963. (French and Spanish summ.); Biological Abstracts, Vol. 45, No. 16, Abst. No. 71308. 1964.

Morphometric and meristic data and color notes were obtained for numerous specimens comprising graded series covering the range of sizes available for each of the five species of Thunnus occurring in the western North Atlantic. These are the bluefin tuna, T. thynnus, the yellowfin tuna, T. albacares, the albacore, T. alalunga, the blackfin tuna, T. atlanticus, and the bigeye tuna, T. obesus. Proportions, counts, and color descriptions are presented for the genus as a whole. The respective species are compared with emphasis on allometric development. Characters important for identification include the count of gill rakers, the lengths of the pectoral fins, the head, and the second dorsal lobe, the maximum depth, and the diameter of the iris. The head and anterior portion of the body become relatively shorter with growth, whereas the posterior portion of the body and the second dorsal, anal and caudal fins become relatively longer. The first dorsal and ventral fins remain relatively unchanged, and the pectoral, except in T. alalunga, is at its maximum relative size in medium-sized individuals of the respective species. Color characters important for identification include the white posterior edge of the caudal fin of T. alalunga, and the absence of yellow in the finlets of live T. atlanticus. A key for the identification of Thunnus species of the western North Atlantic based on external characters is presented. A preliminary comparison indicates that bluefin tuna of the eastern and western Atlantic differ from each other at the racial level at the most, and from those of the eastern Pacific at the subspecific level. Examinations of albacore from opposite sides of the Atlantic reveal no distinct morphological differences. Length frequencies of samples from the two regions indicate a distinct size segregation, with large individuals to the west and small ones to the east, possibly all belonging to one population. (Auth.)

7913. Rodriguez-Roda, Julio. (Inst. Invest. Pesqueras, Cadiz, Spain). 1964. BIOLOGY OF TUNA, THUNNUS THYNNUS (L.) IN THE SOUTHERN ATLANTIC COAST OF SPAIN. (BIOLOGIA DEL ATUN, THUNNUS THYNNUS (L.) DE LA COSTA SUDATLANTICA DE ESPANA.) Invest. Pesquera, 25: 33-146. Illus. (English summ.); Biological Abstracts, Vol. 45, No. 16, Abst. No. 71314. 1964.

This study is based on 1699 bluefin tuna obtained from 1956 to 1961 in trap nets installed in the southwest coasts of Spain. Data include length, weight and age. Relationships between different variables are studied separately according to age, sex and time. Two kinds of tuna can be separated on the basis of the relation between length and weight; the tuna of "derecho" arrive to the Spanish coasts in May and June, very fat and with gonads ripening or in a prespawning state. The tuna of "reves" appear in July and August, meager and with the gonads in a postspawning state. On the average, a loss of 15% in weight is observed in the passage from the "derecho" to the "reves" phase. In the 1st days of each period of passage, average length of fishes is greater than in the 2nd half of the period. Age determinations were based on winter ring counts in the 4th or 5th precaudal vertebrae, but only about one 3rd of the examined vertebra allowed a reliable observation. Average lengths at the time of annual rings O to X are, in cm: 29, 55.3, 79, 116.2, 130.1, 146.0, 165.1, 178.1, 192.9, 206.5, 220.3. Several formulae are tested to calculate length at given ages and also length at infinite age (355.8 cm). Minimal size at spawning is 115 cm (3 years). A number of observations on relative weight of liver and gonads were made. In most instances, females outnumber males. Only a few observations on very young fishes have been made: their growth is rapid. Average number of branchial spines: 13.2 dorsal and 25.17 ventral. Average number of pinnulae: 8.81 dorsal and 7.76 ventral. There were a few observations of food and feeding, parasites and tagging.--R. Margalef.

7914. Smirnov, A. I. 1959. HYBRIDIZATION OF PACIFIC SALMONIDAE OF VARIOUS GENERA. (MEZHRODOVAYA GIBRIDIZATSIYA TIKHOOKEANSKIKH LOSOSEI.). Priroda, 6. 98-100.; Referat. Zhur., Biol., 1960, No. 50567 (translation); Biological Abstracts, Vol. 45, No. 16, Abst. No.

71318. 1964.

Experimental hybridization was carried out between various spp. of the genus of Pacific salmon and between salmon and chars. Eggs of Siberian char (Salvelinus leucomaenis) were fertilized with the milt of coho salmon (Oncorhynchus kisutch). Hybrids hatched in 54 days. After the pigmentation of eyes, approximately 95% of the eggs were alive. By the end of incubation the losses reached 30%. A part (84%) of the embryos were cyclopean form. These embryos died in the last period of incubation. The cyclopean forms that survived grew very slowly. Various abnormalities were described. Incubation of this intergeneric hybrid gave better results than some hybridization experiments within the genus Oncorhynchus. This shows that hybrid analysis give insufficiently defined results in the determination of the affinity between spp. --Courtesy NSF (PL 83-480) 1963.

7915. Smirnov, A. I. 1959. DIFFERENCES IN THE BIOLOGY OF REPRODUCTION AND DEVELOPMENT BETWEEN THE DWARF NONMIGRATORY LACUSTRINE FORM AND THE ANADROMOUS FORM OF SOCKEYE (ONCORHYNCHUS NERKA WALBAUM). (OTLICHIYA V BIOLOGII RAZMNOZHENIYA I RAZVITII OSTATOCHNOI ILI KARLIKOVOI I PROKHODNOI NERKI (ONCORHYNCHUS NERKA (WALBAUM)). Nauchn Dokl Vysshei Shkoly Biol Nauki 3. 59-65; Referat. Zhur., Biol., 1960, No. 76527. (Translation); Biological Abstracts, Vol. 45, No. 16, Abst. No. 71319. 1964.

The lacustrine existence of the dwarf form of O. nerka has led to changes in morphological features of embryos and adults and to ecological differences from the anadromous form. These changes indicate the range of intraspecific adaptive variability, and are no basis for separation of the dwarf form as a distinct morpha. The presence of the 2 forms of O. nerka, enables the sp. to survive varying conditions. --Courtesy NSF (PL 83-480) 1963.

7916. Sprague, Lucian M., James R. Holloway, and Leslie I. Nakashima. (U.S. Bur. Comm. Fish., Biol. Lab., Honolulu, Hawaii). 1962. STUDIES OF THE ERYTHROCYTE ANTIGENS OF ALBACORE, BIGEYE, SKIPJACK, AND YELLOWFIN TUNAS AND THEIR USE IN SUBPOPULATION IDENTIFICATION. In: Proceedings of the World Scientific Meeting on the Biology of tunas and related species, La Jolla, California,; FAO Fish Repts 3(6): 1381-1393. 1963. (French and Spanish summ.); Biological Abstracts, Vol. 45, No. 16, Abst. No. 71322. 1964.

Initial studies of the serology of albacore, bigeye, skipjack, and yellowfin tunas are discussed. The discovery in bigeye of a blood group system containing two blood factors, A and B, which form four phenotypes A, B. AB, and O is noted, and gene frequency estimates are calculated consonant with the hypothesis that the system is determined by the inheritance pattern of three allelic genes. The importance of being able to study such systems for subpopulation analysis is pointed out. The relationships of several other blood factors within the four tunas studied were discussed and the K set of blood factors in the B system of skipjack was analyzed. This system provided evidence for reproductive isolation between at least two and probably three subpopulations in the area of four island groups: Hawaii, the Marquesas, the Tuamotu, and the Society Islands. (Authors)

7917. Tilton, John E., and Richard L. White. 1964. RECORDS OF MENIDIA BERYLLINA FROM SEVERAL CENTRAL TEXAS IMPOUNDMENTS. Texas Jour. Sci., 16(1): 120.; Biological Abstracts Vol. 45, No. 16, Abst. No. 71329. 1964.

Menidia beryllina is recorded from several upstream reservoirs in Texas. Previous records confined its distribution to the coastal regions of the state. (Authors)

7918. Trusov, V. Z. 1958. BIOLOGICAL GROUPS OF THE PIKE-PERCH IN CONNECTION WITH ITS BREEDING IN RESERVOIRS. (O BIOLOGICHESKIKH GRUPPAKH SUDAKA V SVYAZI S EGO RAZVEDENIEM V VODOKHRANILISHCHAKH). Izvest. Vses. Nauchn-Issled Inst. Ozernogo. I Rechnogo. Rybn. Khoz. 45: 226-246.; Referat. Zhur., Biol., 1960, No. 25624. (Translation).; Biological Abstracts, Vol. 45, No. 16, Abst. No. 71330. 1964.

Lucioperca lucioperca L. is not biologically uniform. Its 3 main biological groups were distinguished on the basis of liminal temperature of spawning, relation to the quality of spawning substratum, depth of immersion and the degree of development of the instinct to drift downstream. Formation of the population of L. lucioperca in the Tsimlyansk Reservoir is discussed. It is recommended that various biological groups be used for stocking reservoirs, in accordance with the specific conditions of the reservoir. The bibliography contains 83 references. --Courtesy NSF (PL 83-480) 1963.

7919. Watson, Margaret E. (Woods Hole Oceanog. Inst., Woods Hole, Mass.). 1962. TUNAS (GENUS THUNNUS) OF THE WESTERN NORTH ATLANTIC. I. KEY TO THE SPECIES OF THUNNUS BASED ON SKELETAL AND VISCERAL ANATOMY. In: Proceedings of the World Scientific Meeting on the Biology of tunas and related species, La Jolla, California.; FAO Fish Repts., 3(6): 1153-1154. (French and Spanish summ.); Biological Abstracts, Vol. 45, No. 16, Abst. No. 71333. 1964.

The genus Thunnus, comprising six species, possesses 39 vertebrae – the first of which is no more than half as long as the second. This characteristic separates genus Thunnus from all other known genera without exception, and it can be diagnosed by soft-X-ray photographs in specimens as small as 9 mm fork length. T. thynnus, T. alalunga and T. obesus form Group I whose diagnostic features are recognizably different from those in Group II containing T. albacares, T. atlanticus (found only in the Atlantic) and T. tonggol (found only in the Pacific). Each group is then analyzed for specific differences within the group. The key formulated is useful for ready identification of species, either by X-ray photographs or by examination of the abdominal cavity and gill rakers.

Species differences apply to individuals 20 cm or longer in fork length. T. tonggol is proposed as the correct name for T. argentivittatus (MNHN A5814, Rivas 1961) supported by skeletal, visceral and external evidence. (Auth.)

7920. Kühme, Wolfdietrich (Max- Planck-Inst. Verhaltensphysiol, Seewiesen/Starnberg, Germany). 1964. A CHEMICALLY INDUCED CARE-OF-THE-YOUNG REACTION IN CICHLIDS (PISCES). (EIN CHEMISCH AUSGELÖSTE BRUTPFLEGEREAKTION BEI CICHLIDEN (PISCES)). Naturwissenschaften 51(1): 20-21.; Biological Abstracts, Vol. 45, No. 17, Abst. No. 71914. 1964.

Experiments indicate that the oxygen- or carbon dioxide content of the water may respectively inhibit or actuate the fanning action of the female over the young during certain periods, and that the adult fish are capable of distinguishing between their own and strange broods. --J. Grauman.

7921. Whitmore, Cecil M. (Fish Commission of Oregon, Portland). 1965. A MICROCYTIC ANEMIA OF JUVENILE CHINOOK SALMON RESULTING FROM DIETS DEFICIENT IN VITAMIN E. Fish Commission of Oregon, Contribution No. 29, Portland, Oregon, 31 p.

An anemia of juvenile chinook salmon (Oncorhynchus tshawytscha) is described and stages of development separated by recognizable syndromes. A vitamin E-deficient diet of low rancidity produced a severe microcytic anemia with strong immature red cell response and granulocytosis occurring 2 to 4 weeks before a drop in hemoglobin and hematocrit values. A vitamin E deficiency in association with diets of high rancidity produced a more severe anemia with impaired and delayed blood regeneration, microcytosis, abnormal red cell development, and a pronounced granulocyte response; complete recovery resulted when vitamin E was added to the diet. (Auth.)

7922. Magnuson, John J. (U.S. Bur. Comm. Fish., Biol. Lab., Honolulu, Hawaii). 1962. TUNA BEHAVIOR AND PHYSIOLOGY. A REVIEW. In: Proceedings of the World Scientific Meeting on the Biology of tunas and related species, La Jolla, California.; FAO Fish. Repts., 3(6): 1057-1066. 1963. (French and Spanish summ.); Biological Abstracts, Vol. 45, No. 17, Abst. No. 71921. 1964.

Published data on tuna behavior and to a lesser extent tuna physiology are reviewed. Feeding behavior and schooling behavior are covered more intensely. Data relevant to tuna behavior have been collected primarily by indirect methods, such as examination of stomach contents, distributions of tuna on longlines, etc. The use of sonar is also being expanded. Most studies of tuna behavior require direct observations of the behaving animal. Methods of making direct observations at sea from airplanes, or through underwater portholes in ships have been developed, as have methods of observing tuna directly in captivity. Studies on mackerel also provide information useful in understanding tuna behavior. In the author's opinion ethological study of tuna in captivity will provide the most rapid rate of increase in the understanding of tuna behavior. (Auth.)

7923. Schwassmann, Horst O. (Lab. Limnol., Univ. Wis., Madison, Wis.), and Arthur D. Hasler. 1964. THE ROLE OF THE SUN'S ALTITUDE IN SUN ORIENTATION OF FISH. Physiol. Zool., 37(2): 163-178. Illus.; Biological Abstracts, Vol. 45, No. 17, Abst. No. 71939. 1964.

Green sunfish and 2 species of cichlids were trained in a circular tank to swim in compass directions. The sun, or a substituted light indoors, were orienting cues for a compass direction. Well trained fish of 3 species allowed precisely for the rate of movement of the sun's azimuth at 43°N and at 1°S. Green sunfish, reared from the egg in the laboratory, responded to the rate of change of the sun's altitude in their first tests under the sun. This response to the altitude of the sun establishes a daily pattern of change in the horizontal angle to the sun, to which the fish were trained. After this pattern was established, a different rate of change in the sun's altitude had no further influence. Two fish, which had been trained and tested to the sun at one latitude, throughout the entire day, were tested at a different latitude. When the sun's altitude was at least 10 degrees greater than at the original latitude, at the same time of day, both deviated from the angle to the sun to which they had been trained. (Authors)

7924. Bodrova, N. V., and B. V. Krayukhin. 1958. REACTION OF FISH TO ALTERNATING ELECTRIC CURRENT. (O REAKTSII RYB NA VOZDEISTVIE ELEKTRICHESKIM TOKOM). Tr. Soveshch. Ikhtiol. Komis. Akad. Nauk. SSSR 8. 124-131.; Referat. Zhur., Biol., 1960, No. 6498. (Translation); Biological Abstracts, Vol. 45, No. 17, Abst. No. 72106. 1964.

Alternating current decreases the respiratory rate of fish in direct proportion to the amount of current (in milliamperes per 1 cm^2 of the surface of electrodes). Weak, constant current acting during several days has the same effect. In this case experimental fishes (Carassius sp., Carassius auratus, Ictalurus nebulosus, Cyprinus carpio) died with distinct signs of asphyxiation due to deep depression of respiratory centre and disturbances in the peripheral nervous system. Prolonged action of a weak current causes darkening of fish. Short-lasting, strong, alternating current causes depigmentation of some fish species (Acerina cernua, Raja sp.). Fishes of various species react differently to current of the same strength. Bibliography with 31 references. --Courtesy NSF (PL 83-480) 1963.

7925. Dean, Howard J. (Herbicide and Pesticide Unit., State Fish Hatchery, Rome, N. Y.). 1963/1964. WHY THE LAKE TROUT FRY DIED: DDT. Conservationist 18(3): 5-7. Illus.; Biological Abstracts, Vol. 45, No. 17, Abst. No. 72110. 1964.

7926. Dyk, Vaclav. 1963. SALVELINUS FONTINALIS IN CZECHOSLOVAKIA. (SIVENI V NASICH VODACH). Ziva 11(5): 171. Illus.; Biological Abstracts, Vol. 45, No. 17, Abst. No. 72111. 1964.

Several individuals of Salvelinus fontinalis were introduced into Cerne jezero (Black Lake) in the west Bohemian mountains and the acclimatization has been complete. The description of the fish is given and some distinguishing characteristics are emphasized. This species has completely absorbed S. alpestris, previously prevalent in the same areas. In some areas, crossbreeding with trout resulted in a new breed of "tiger fish". --J. Burnett.

7927. Ehrlich, S. 1964. STUDIES ON THE INFLUENCE OF NUTRIA ON CARP GROWTH. Hydrobiologia 23(1/2): 196-210. Illus.; Biological Abstracts, Vol. 45, No. 17, Abst. No. 72112. 1964.

Data from 9 experiments carried out in fish ponds in Poland showed that the breeding of nutria is a potent means of increasing carp production. Densities of up to 55 nutria per hectare were used and the indications are that even higher concentrations should give higher production rates of carp. Increases in carp growth of over 250% are recorded in the experiments. The results of the experiments are analyzed statistically. --K. E. Marshall.

7928. Frantz, Ted. 1963. FOOD HABITS OF TAHOE TROUT INTERESTING. Nevada Wildlife, 3(12): 4-5. Illus.; Biological Abstracts, Vol. 45, No. 17, Abst. No. 72115. 1964.

7929. Peters, Hans M. (Univ. Tubingen, Tubingen, W. Germany.). EGG NUMBER, EGG WEIGHT AND DEVELOPMENT OF THE SPAWN IN THE GENUS TILAPIA. (EIZAHL, EIGEWICHT UND GELEGEENTWICKLUNG IN DER GATTUNG TILAPIA (CICHLIDAE, TELEOSTEI). Internatl Rev. Ges. Hydrobiol. 48(4): 547-576. 1963. (English summ.); Biological Abstracts, Vol. 45, No. 17, Abst. No. 72127. 1964.

Seven species of Tilapia were studied. Some forms were substrate breeders, and some were mouth breeders. In the former the eggs were smaller than in the latter, and contained less yolk. Within both groups the eggs varied considerably in size, but the size was proportional to the body weight of the mother fish. Also, the average number of eggs in a single spawn was greater in the larger fishes, but the individual eggs in a large spawn were smaller than in a small spawn from fish of equal size. The eggs of differing sizes appeared to vary because of their yolk content, and not because of the amount of cytoplasm. --C. C. Davis.

7930. Honma, Yoshiharu, and Eimitsu Tamura. (Dept. Biol., Fac. Sci., Niigata Univ., Niigata, Japan). 1962. SEASONAL CHANGES IN THE GONADS OF THE LAND-LOCKED SALMONOID FISH, KO-AYU, PLECOGLOSSUS ALTIVELIS TEMMINCK ET SCHLEGEL. Japanese Jour. Ichthyol. 9(1/6): 135-152. Illus. (In Japanese with English summ.); Biological Abstracts, Vol. 45, No. 17, Abst. No. 73169. 1964.

Histological examination of gonads of P. altivelis revealed that growth of the ovary is correlated with an increase in the number and size of the germ cells. The gonads of juvenile fish (called Hi-uwo) taken in November and December originate from the dorsal fold of the splanchnic mesoderm, but the initiation and mode of sexual differentiation was undetermined. The histological differences between the ovary and testis become distinct in the material of January. The ovarian eggs are yolkless from January to July. In the pre-spawning season, August to September, vitellogenesis occurs rapidly, the eggs then reaching a ripe stage. The developmental stages of ovarian eggs contained in a single ovary of Koayu are not quite synchronous. Several groups of young oocytes at the stage of peri-nucleoli have been found in the ovigerous folds of the spent gland of the so-called Otu-nen Koayu that have survived after spawning. Development of the ovarian eggs of the Otu-nen Koayu might be classified as partial synchronism. It seems probable that the hypertrophic granulosa cells merely play a part in the destruction, transfer, and ingestion of oolemma and egg contents, such as yolk and ooplasm, during the formation of corpora lutea of pre-ovulation atretic eggs in the spent ovary of fish. The primordial germ cells, the primary spermatogonia under the growth and multiplication periods, were detected in the testes of fish obtained from January to June. The sperm are ejected outside the testis after formation of spermatozoa in September. The maturity of the cells contained in a single testis is synchronous. In the cystic wall of the spent testis there appeared a layer of spermatogonia in the resting stage, newly formed after the first spawning. The fate of these new spermatogonia during the survival time of the fish is questionable.

(From Auth. summ.)

7931. Chusovitina, L. S. 1963. POSTEMBRYONIC DEVELOPMENT OF THE SIBERIAN STURGEON ACIPENSER BAERI BRANDT. (POSTEMBRIONAL'NOE RAZVITIE SIBIRSKOGO (ACIPENSER BAERI BRANDT) OSETRA.). Tr Ob'-tazovsk otd gos nauchn-issled Inst. Ozernogo Rybn. Khoz. 3: 103-114.; Referat. Zhur., Biol., 1963, No. 2318. (Translation); Biological Abstracts, Vol. 45, No. 17, Abst. No. 75738. 1964.

Organogenesis of larvae is completed for the most part 14 to 15 days after hatching at 17-18° C. (at an average length of 21-22 mm) when larvae go over to active feeding. A characteristic feature of the onset of the active feeding period is the appearance of rudimentary dorsal scuta in the finfold.

7932. Reshetnikov, Yu. S. (Inst. Animal Morphol., Acad. Sci. USSR, Moscow, USSR). 1963. COREGONUS VARIABILITY. (OB IZMENCHIVOSTI SIGOV). Zool. Zhur., 42(8): 1187-1199. (English summ.); Biological Abstracts, Vol. 45, No. 17, Abst. No. 75740. 1964.

An analysis of Coregonus variability showed that even within one Coregonus population similar in the number of gill-rakers, considerable deviations are observed between Coregonus of different size, between males and females, between fishes from areas of the same lake, as well as between Coregonus of different lakes. All the Coregonus of

the Scandinavian peninsula can be divided by the number of gill-rakers into 2 groups as follows: those where the number of gill-rakers is 19-30, and those where this number reaches from 30 to 45-50. As a rule, only Coregonus with the small number of gill-rakers are dwelling in the rivers, while both groups occur in the lakes. All of them belong to 1 sp., C. lavaretus (L.). Despite several differences between single Coregonus populations, it is hardly reasonable to give a name to each for since practically each waterbody has its own form, and, apart from this, the amplitude of variability of almost all characters is common for all the forms, differences being observed but in average values. C. clupeaformis (Mitchill) has many features in common with C. lavaretus, therefore, the present author tends to refer C. clupeaformis to the species C. lavaretus. Great variability of the species C. lavaretus as a whole mirrors its adaptation to its environment. The development of a diversity of forms in this species (polymorphism) which take different ecological niches should be regarded as an adaptation to their life in northern waterbodies which are poor in foods, as well as their broad spectrum of feeding (euryphages) which allows the species to use the foods of these waterbodies to the full extent. There is a bibliography with 34 references. (Auth.)

7933. Srivastava, M. D. L., and Darshan Kaur. (Zool. Dept., Allahabad Univ., Allahabad, India). 1961. THE STRUCTURE AND BEHAVIOUR OF CHROMOSOMES IN SIX FRESH-WATER TELEOSTS. In: 31st Annual Session of the Annual Session of the National Academy of Sciences of India, Dehra Dun, 1962; Natl Acad. Sci. India Ann. No. 1961: 108. 1961 (rec'd. 1963); Biological Abstracts, Vol. 45, No. 18, Abst. No. 76106. 1964.--Abstract only.

7934. Threadgold, L. T. (Zool. Dept., Queen's Univ., Belfast, N. Ireland), and A. H. Houston. 1964. AN ELECTRON MICROSCOPE STUDY OF THE "CHLORIDE CELL" OF SALMO SALAR L. Exptl. Cell Res., 34(1): 1-23. Illus.; Biological Abstracts, Vol. 45, No. 18, Abst. No. 76109. 1964.

The fine structure of the "chloride cell" in 4 classes of salmon, has been studied. In the fresh water parr, which showed some loss of osmoregulatory ability, chloride cells were inactive or degenerate, with an arrest in the process of chloride cell replacement and differentiation. In the fresh water smolt and 10-day sea water adapted smolt, plasma electrolyte levels were efficiently regulated, and the replacement and differentiation of chloride cells appeared normal and cell activity was low to moderate. The smolt adapted to sea water for 72 hours, had heightened plasma, electrolyte levels, and the chloride cells showed enhanced secretory activity with large extracellular excretory masses. The morphology of the "chloride cell" therefore is correlated with plasma electrolyte levels. An hypothesis of the secretion mechanism of the "chloride cell" is proposed. It involves, (1) transport of electrolytes from the branchial blood by means of infoldings of the basal plasma membrane of the chloride cell; (2) inward growth of this tubular system into the subapical region of the cell; (3) the pinching off of distal parts of the tubules to give microvesicles; (4) the migration of the microvesicles to the plasma membrane, where they fuse with the latter and release their electrolytes; the concentration of the chloride within the tubules by withdrawal of water between stages (2) and (3). Pertinent literature concerning the "chloride cell" and osmoregulation in fishes is discussed. It is concluded that the study adds support to the Keys-Willmer hypothesis of the participation of chloride cells on regulation of plasma electrolyte levels in fish. (Authors)

7935. Henderson, Herman Francis. 1963. ORIENTATION OF PELAGIC FISHES. I. OPTICAL PROBLEMS. II. SONIC TRACKING. Dissert. Abst., 24(6): 2626.; Biological Abstracts, Vol. 45, No. 18, Abst. No. 76316. 1964.--Abstract only.

7936. Belyi, N. D. (Inst. Hydrobiol., Acad. Sci. Ukrain, SSR, Kiev, Ukrain. SSR). 1963. REPRODUCTION OF THE BREAM (ABRAMIS BRAMA L.) ON NESTS IN THE LOWER DNEPR. (RAZMNOZHENIE LESHCHA (ABRAMIS BRAMA (L.)) NA GNEZDAKH V NIZOV'YAKH DNEPRA). Izvest. Akad. Nauk. SSSR Ser. Biol., 28(4): 547-554. Illus. 1963. (English summ.); Biological Abstracts, Vol. 45, No. 18, Abst. No. 76453. 1964.

Bream spawned at 5 to 11 A. M. In natural spawning places in the flood-plain of the Bielaya river the fish gathered in deep places and moved to spawning plots 0.1 to 0.5 m deep. Courtship behavior accompanied by removal of sludge sediments from the substrate preceded spawning. Thereafter movements were suspended and resumed after several minutes. Spawn were disseminated over large areas by vigorous movements performed by the female. No such movements were noted in nest spawning so that the entire mass of spawn released by the female was concentrated in the substrate of the nest. Beyond the nest only 0. to 1.8% of spawn might be found. In the lower Dniepr artificial nests were inseminated by the bream at a depth of 0.5 to 6 m where the streaming rate from 0 to 0.2 m/sec and water transparency is 35-180 cm. By means of artificial spawning plots the fisheries of the Kherson Fish plant regularly obtain tons of fertilized bean eggs and other spawn each year. (Authors)

7937. Besse, P., and A. M. Normand. 1963. THE CELLULAR AND CHEMICAL CHARACTERISTICS OF BLOOD OF NORMAL RAINBOW TROUT IN COMMERCIAL PRODUCTION (SALMO GAIRDNERI RICHARDSON). (RECHERCHES SUR LA COMPOSITION CELLULAIRE ET CHIMIQUE DU SANG DE LA TRUITE ARC EN CIEL D'ELEVAGE (SALMO GAIRDNERI RICHARDSON)). Bull. Acad. Vet. France 36(8): 389-391.; Biological Abstracts, Vol. 45, No. 18, Abst. No. 76454. 1964.

Trout were bled by cutting the tail behind the anus. Data on 12 males and 15 females, aged to 6 years, are given for blood cell counts, glucose, protein, urea, cholesterol and electrophoretic protein assays.--R. J. Main.

7938. Kudryashova, Yu. V. 1963. EFFECT OF DIFFERENT FOOD RATIONS ON THE BLOOD COMPOSITION OF FINGERLING CARP. (VLIYANIE RAZLICHNYKH KORMOVYKH RATSIONOV NA SOSTAV KROVI SEGOLETKOV KARPA). Dokl. Mosk. Sel'skokhoz Akad. Im. K. A. Timiryazeva 85. 363-366.; Referat. Zhur., Biol., 1963, No. 14I76. (Translation); Biological Abstracts, Vol. 45, No. 18, Abst. No. 76468. 1964.

In fishes receiving artificial food, blood phagocytic elements (monocytes and polymorphonuclear leucocytes) became elevated from the normal value of 2.2 to 5.9-21.4%. The largest amount of these elements was observed in fish fed with linseed oil cake and soybean groats. These fish also manifested the lowest percentages of erythrocytes and of unripe erythrocytes. Results indicate that linseed oil cake and soybean groats are not full-value foods.

7939. Pestova, I. M. 1962. HEMOPOIESIS IN LAKE SALMON, DEVELOPING AT DIFFERENT WATER TEMPERATURES. (KROVOTVORENIE U OZERNOGO LOSOSYA, RAZVIVAYUSHEGOSYA PRI RAZLICHNOI TEMPERATURE VODY). Tr. Permsk. Med. Inst., 1. 36. 169-175.; Referat. Zhur., Biol., 1963, No. 8I70. (Translation); Biological Abstracts, Vol. 45, No. 18, Abst. No. 77503. 1964.

On the basis of a study of the process of hemopoiesis in lake salmon (Salmo salar sebago), 4 stages of development were delineated, characterized by differentiation of cells in the axial mass in the hemocytoblasts; appearance of the forst blood cells in the vessels, hemopoiesis in the kidney and hemopoiesis in the spleen. With increase in temperature from 0 to +6° C. the following were noted: a more rapid development of cells of the axial mass, their more rapid proliferation, an earlier beginning of circulation, acceleration of maturation of erythrocytes and increased hemopoiesis in the wall of the glandular sac. Increase in temperature to 8° led to decrease in the proliferation of blood cells and fluctuations in mitotic division.

7940. Balashev, V. N. 1961. INTRAORGANIC GASTRIC LYMPHATIC SYSTEM IN SOME FISHES. (VNUTRIORGANNAYA LIMFATICHESKAYA SISTEMA ZHELDUKA NEKOTORYKH RYB). Tr. Leningradsk Saint Gig Med. Inst. 65: 74-81.; Referat. Zhur., Biol., 1963, No. 19I13. (Translation); Biological Abstracts, Vol. 45, No. 18, Abst. No. 77591. 1964.

An intraorganic lymphatic system was found in the stomachs of burbots, pikes, brills, and thornback rays. It consists of dense lymphatic capillary networks embedded in both the mucous and muscular membranes. Lymph flows off through abducting lymphatic vessels or through perivascular sheaths of lymphatic capillaries in blood vessel adventitia.

7941. Motais, R., and J. Maetz. (Groupe Biol. Marine Dept. Biol. C.E.A., Sta. Zool. Villefranche-sur-Mer, France). 1964. THE ACTION OF NEUROHYPOPHYSEAL HORMONES ON SODIUM EXCHANGE (MEASURED USING RADIO-SODIUM Na^{24}) IN A EURYHALINE TELEOST: PLATICHTHYS FLESUS L. (ACTION DES HORMONES NEUROPHYPOPHYSAIRES SUR LES ECHANGES DE SODIUM (MEASURES A L'AIDE DU RADIO-SODIUM Na^{24}) CHEZ UN TELEOSTEEN EURYHALIN: PLATICHTHYS FLESUS L.). Gen. and Comp. Endocrinol., 4(2): 210-224. Illus. 1964. (English summ.); Biological Abstracts, Vol. 45, No. 18, Abst. No. 77746. 1964.

Techniques for the measurement of sodium exchange in the euryhaline flounder Platichthys flesus, either adapted to sea or to fresh water or when undergoing a change from fresh to sea water, are described, as are the theoretical bases for these calculations. In the flounder adapted to fresh water the influx and outflux of sodium are in the order of 1 mg/100 gm body weight/hr that is the sodium exchange involves at the most 1% of the exchangeable sodium per hour. The injection of oxytocin produces a transitory increase of the outflux and a more lasting increase of the influx of sodium. In the flounder adapted to sea water the sodium exchange is considerably greater, being in the region of 25% of the exchangeable sodium per hour (about 33 mg/100 gm body weight/hr). Oxytocin increases the rate of exchange to an average of 47 mg/100 mg/hr, i.e., 35% of the exchangeable sodium. Lysine vasopressin has no effect. Fish transferred from fresh water to sea water show a progressive increase of the sodium outflux. This augmentation is most rapid in small individuals and in fishes that have only been subjected to a short preliminary period of adaptation to fresh water. Oxytocin accelerates the increase of sodium outflux associated with the change of milieu. It seems probable that the neurohypophysial hormones intervene in the mineral regulation of this euryhaline fish by increasing the sodium absorption by the gills in fresh water and sodium excretion in sea water. (Authors)

7942. Freeman, Reino S. (Ontario Res. Found., Toronto, Ontario, Canada). 1964. ON THE BIOLOGY OF PROTEOCEPHALUS PARALLACTICUS MACLULICH (CESTODA) IN ALGONQUIN PARK, CANADA. Canadian Jour. Zool., 42(3): 387-408. Illus.; Biological Abstracts, Vol. 45, No. 18, Abst. No. 80068. 1964.

Proteocephalus parallacticus MacLulich is common throughout the year in lake trout (Salvelinus namaycush). Beginning in late May or early June and continuing to early autumn, gravid worms occur throughout the summer in approximately 25% of the 3 to 4 years old or older. Plerocercoids may develop within 30 to 40 days at 16° C. in Cyclops bicuspidatus, C. vernalis, and probably C. scutifer, but not in several other copepods which were tested; female C. bicuspidatus are most suitable. Normal growth is rare in copepods at 20° C, and probably little growth occurs below 10° C. In the gut of the trout plerocercoid I, the plerocercoid from the copepod, requires at least 30 to 40 days at optimal 12° C. to grow to plerocercoid II, which is morphologically identical to but approximately 10 times larger than plerocercoid I; in another 35 days or less plerocercoid II segments and grows to a gravid adult.

The maximum temperature for growth is approximately 14° C., and growth is slow below 10° C. Trout may be infected directly with plerocercoid I from the copepod, or with plerocercoids varying from I to II taken from the gut of other fish. Thus the plerocercoid of P. parallacticus has two phases of growth, one in the copepod and the other in the fish. The latter occurs within the gut rather than parenterally as with P. ambloplitis. (Auth.)

7943. Nikolyukin, N. I., and N. A. Timofeeva. 1960. TRIPLE HYBRIDS OF STURGEON. (TROINYE GIBRIDY OSETROVYKH RYB.). Tr Saratovsk Otd Cos Nauchn Issled Inst. Ozernogi I Rechnogo Rybr Knoz 6: 140-177.; Referat. Zhur., Biol., 1963, No. 8I2. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80562. 1964.

An analysis is made of the morphological characteristics of 3 triple hybrids [sturgeon female (Acipenser guldenstadti) X (Huso huso female X sterlet male); Huso huso female X (sterlet X Acipenser stellatus male); sterlet female X (sterlet female X Acipenser stellatus male)]. For these as well as for F_1 hybrids, an intermediate heredity was characteristic. Heterosis in triple hybrids in comparison with F_1 hybrids was considerably reduced. The lethal oxygen threshold in the hybrid sturgeon female X (Huso huso female X sterlet male) was somewhat lower than in sturgeon. In Huso huso and its hybrid with a specimen obtained from crossing sterlet female with Acipenser stellatus male the oxygen threshold at the age of 50 days was almost the same. The threshold concentration of O_2 decreased with increase in weight and age in both forms. With change in the average weight of the hybrid from 7.2 to 18.1 g the oxygen threshold decreased from 1.46 to 0.64 mg/liter, and in Huso huso with change in weight from 8.9 to 16.9 g the threshold concentration decreased from 1.48 to 0.85 mg/liter. A hematological characterization of Huso huso and its hybrid with (sterlet female X Acipenser stellatus male) was carried out; the histological structure of the sex glands in this hybrid form is described. A conclusion is reached regarding the possible natural formation of triple hybrids in sturgeon.

7944. Bodrova, N. V., and B. V. Krayukhin. 1962. SPECIES VARIABILITY IN THE TRANSITION OF FISH FROM THE INITIAL REACTION TO THE ELECTRONARCOTIC STAGE UNDER THE INFLUENCE OF AN ELECTRIC CURRENT. (O VIDOVYKH RAZLICHIYAKH PEREKHODA RYB OT PERVICHNOI REAKTSII K STADII ELEKTRONARKOZA PRI VOZDEISTVII NA NIKH ELEKTRICHESKIM TOKOM). Byul Inst. Biol. Vodokhran Akad. Nauk. SSSR 13. 33-35.; Referat. Zhur., Biol., No. 12I72. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80881. 1964.

According to their sensitivity to an alternating current, as determined by the initial reaction, the fish studied can be separated into 3 groups: fish which are most sensitive (pike), fish which are semisensitive (blue bream, roach, perch, ide, bream), and fish which are least sensitive (zander, burbot, tench). In the first group, the initial reaction is elicited by a current under a pressure of 0.4 volt; in the second group by about 0.6 volt; in the 3rd group, 0.84-1.24 volts. The transition from the initial reaction to the electronarcotic stage occurs in fish of the first group at a voltage which exceeds the threshold voltage by a factor of 7.1; in the 2nd group, by a factor of 5.3; in the 3rd group, by a factor of 3.3. The unequal development of the peripheral receptors and of the corresponding nerve centers in various fishes determines, apparently, not only the sensitivity to the current, but also the characteristics of the transition from the initial response to the electronarcotic stage.

7945. Boldina, I. K. 1962. A CONTRIBUTION TO THE PROBLEM ASSOCIATED WITH THE FEEDING OF WHITE-EYED BREAM IN GORKY RESERVOIR. (K VOPROSU O PITANII BELOGLAZKI V GOR'KOVSKOM VODOKHRANILISHCHE). Byul Inst. Biol. Vodokhran. Akad. Nauk. SSSR 13. 31-32.; Referat. Zhur., Biol., 1963, No. 12I45. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80882. 1964.

The basic food of the white-eyed bream (Abramis sapa) of 126-331 mm length (103 specimens) in the Gorky Reservoir consists of Sphaeriidae, larvae of Procladius, and oligochaetes. Its feeding conditions have improved somewhat during the time of the existence of the Reservoir. The disappearance of the white-eyed bream from the lower part of the Reservoir is explained not by food factors but by unfavorable conditions for its spawning.

7946. Chang, Kong T'am. 1962. METHODS OF REARING TILAPIA IN THE DEMOCRATIC REPUBLIC OF VIET-NAM. (METODY RAZVEDENIYA TILYAPII V DEMOKRATICHESKOI RESPUBLIKE V'ETNAM). Sb Kokl Na II Plenume Komis Po Rybokhoz Issled Zap Chasti Tikhogo Okeana Moscow Pishchepromizdai 225-232.; Referat. Zhur., Biol., 1963, No. 12I87. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80887. 1964.

In the Democratic Republic of Viet-Nam, Tilapia is propagated in ponds and in rice fields. Fish ponds (not less than 1.5 m in depth) are fertilized with lime or with ashes and manure. Four pairs of adult breeders and 100-200 specimens of 2-month-old fish are planned in 100 m^2 of pond. Breeders are raised separately. It is possible to carry out combined rearing with Cyprinus carpio, Hypophthalmichthys molitrix, and Labeo collaris. Fishes are fed with soaked leaves and grass, as well as with insignificant quantities of rice, corn meal, etc. With adequate feeding a pond 100 m^2 in area can produce 80-100 kg of fish per year. Fenced-in ponds of the rice fields are stocked twice a year with 4-5-cm long Tilapia at the rate of 4500-6000 specimens per hectare. Fertilizers are used. By-products comprise 20% of the food; the fish crop averages 250-380 kg/ha.

7947. Chepurnov, V. S., M. S. Burnashev, Ya. I. Dimitriev, and T. G. Lazur'evskaya. 1962. DAILY RATION AND DAILY FEEDING RHYTHM OF

YOUNG FLOUNDERS (PLEURONECTES FLESUS) IN THE SHABOLAT ESTUARY. (SUTOCHNYI RATSION I SUTOCHNYI RYTM PITANIYA MOLODI GLOSSY V USLOVIYAKH LIMANA SHABOLAT. Uch Zap Kishinevsk Univ. 62(1): 73-80. 1962; Referat. Zhur., Biol., 1963, No. 12I48. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80889. 1964.

Materials (262 specimens) were collected in the spring and summer of 1959. The daily food ration of P. flesus of 5.6-7.5 cm length varied from 250 to 345 mg (5.0-5.7% of body weight). The qualitative composition is more or less similar. Polychaetes form more than 50% of the food. Maximum utilization occurs by night. The feeding rhythm has 3 peaks, with intervals of from 2 to 6 hours.

7948. Danilenko, L. A. 1962. RUN OF PINK SALMON IN THE VOLONGA RIVER. (KHOD GORBUSHI V REKU VOLONGU). Nauchn-Tekh Byul Gos Nauchn-Issled Inst Ozernogo I Rechnogo Rybn Khoz 15. 20-21.; Referat. Zhur., Biol., 1963, No. 8I54. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80892. 1964.

In the Volonga River (Cheshskaya Gulf of the Barents Sea) pink salmon (Oncorhynchus gorbuscha) appeared July 22, 1960; the run continued to Sept. 30, peak from August 15 to 30; 560 passed the counting fence and went upstream not further than 46 km from the mouth. In 1961 the salmon appeared in mid-July, the peak was observed in late July and the end of the run October 1. In 1961, 308 specimens of salmon passed; they ascended to 63 km from the mouth of the river (Travyanka River). The stage of maturity in July was III-IV and IV. The first ripe males were noted August 15. The coefficient of maturity of the females in August averaged 15.4%; fecundity was 1670 eggs (from 1360 to 2002). The average fork length of males was 50.4 cm (35-64) in August 1961, and weight was 1720 g (655 to 3194); in females the length was 46.6 cm (32-55) and weight 1187 g (450-1884).

7949. Doroshev, S. I. 1962. USE OF INTRA-SPECIES VARIABILITY IN WORK ON THE ACCLIMATIZATION OF FISH. (ISPOL'ZOVANIE VNUTRIVIDOVOI IZMENCHIVOSTI V RABOTAKH PO AKKLIMATIZATSII RYB). In: Problemy vnutrividovykh otnoshenii organizmov. (Problems of intra-species relationships of organisms). Tomsk Univ Tomsk 226-228.; Referat. Zhur., Biol., 1963, No. 8I96. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80894. 1964.

For acclimatization it is necessary to consider not only the similarity of conditions in the native and new waters, but also the potential adaptation of the species, as well as to apply the principle of supplementing the stock with one variety of the species at the expense of the other. It is necessary to study the properties of the species under conditions of the medium to which it will be adapted.

7950. Dryagin, P. A. 1961. FUNDAMENTAL TRENDS IN THE STUDY OF LIFE CYCLES OF FISH. (OZNOVNYE NAPRAVLENIYA V IZUCHENII ZHIZNENNYKH TSIKLOV RYB). Nauchn-Tekh Byul Gos Nauchn-Issled Inst Ozernogo I Rechnogo Rybnogo Khoz 13/14. 113-117.; Referat. Zhur., Biol., 1963, No. 8I1. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80895. 1964.

The works of a number of Russian scholars on successive periods of development of fish are discussed, in particular those of S. G. Krzhyshanovskii. The general deficiency of these works is their one-sidedness and the lack of any estimate of the remote effect of various factors on the life cycle of fish as a whole. The principal task of future investigations the author sees in searching for methods of affecting different, particularly early stages of development, for the purpose of increasing the yield and improving the quality of fish production. The initial problems requiring working out are listed for experimental and fish husbandry work, as well as investigations of the life cycles of fish in the natural state.

7951. Dryagin, P. A. 1961. FORMATION OF FISH STOCKS IN USSR RESERVOIRS. (FORMIROVANIE RYBNYKH ZAPASOV V VODOKHRANILISHCHAKH SSSR). Izvest Gos Nauchn-Issled Inst Ozernogo I Rechnogo Rybn Khoz 50: 382-394, 453. (English summ.); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80896. 1964.

Eurpoean lowland reservoirs are divided into southern, (up to 55° N. Lat.) where sheatfish (Silurus glanis) and carp (Cyprinus carpio) are found, and northern where stenothermic species occur: whitefish, cisco, ripus (Coregonus albula ladogensis), peled (Coregonus peled), stint. When reservoirs are constructed, changes in the species composition of fish occur in the direction of decrease in the migratory and semimigratory species, reduction of rheophilic fish and increase in lake and river forms. Changes in the behavior of the fish occur. Thus, among several commercially important migrants (Russian sturgeon, Caspian inconnu (Stenodus l. leucichthys)), maturation and spawning in the dam areas were observed. In some reservoirs, a local stock of migratory and semi-migratory fish is formed. In several reservoirs some rather small changes in the biology of the fish have been observed (changes in the time of maturation, growth rate, character of the diet). Reservoir conditions favor the formation of large stocks of bream, pike, blue bream, chekhon (Pelecus cultratus), and bleak (Culter alburnus). In a number of reservoirs during the first years of their existence, a population explosion of individual species of phytophilic and predacious fishes was observed, in connection with the presence of an abundant food supply and favorable conditions for reproduction. Reservoirs are divided as follows according to the composition of their fish fauna: (1). Carp-zander (Stizostedion sp.) (Tsimlyan, Veselov, Proletarskoe, Kakhov). (2). Bream-zander (Gor'kov, Perm, Rybin, Ivan'kov, Uglich). The principal commercial fish are: bream, zander, pike. (3). Cisco-bream reservoirs (Vygozero). The main commercial fish are: bream, cisco, pike, burbot. (4). Salmon-whitefish (Segozero). The main commercial fish are: cisco, whitefish, grayling, burbot. (5). Carp lowland reservoir (Kairak-Kum). Carp, marinka (Schizothorax intermedius) and khramulya (Varicorhinus capoeta) inhabit these

waters. (6). Trout mountain reservoirs in the Crimea and the Caucasus. A series of measures is proposed for creating more favorable conditions for the development of the fish fauna in reservoirs.

7952. Dyuzhikov, A. T. 1960. COMPOSITION OF THE STOCK AND REPRODUCTION OF RUSSIAN STURGEON ON THE VOLGA BELOW THE LENIN HYDROELECTRIC STATION. (SOSTAV STADA I RAZMNOZHENIE OSETRA NA VOLGE NIZHE VOLZHSKOI GES IMENI LENINA). Tr Saratovsk Otd Gos Nauchn-Issled Inst Ozernogo I Rechnogo Rybn Khoz 6: 76-115.; Referat. Zhur., Biol., 1963, No. 8I44. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80897. 1964.

The Russian sturgeon (Acipenser guldenstädtii) here are composed of small, immature specimens less than 50 cm long and large, mature fish more than 100 cm long. The immature specimens are those which do not descend to the sea in the first year of life. The retention of the young in the river occurs because of the early and low spring floods that occur in some years; emergence of the larvae in these years usually occurs during the decline of the water level, when the flow of many secondary branches of the river slacks off or dries up. Larvae hatching into such waters are in a favorable location for feeding. The second important factor contributing to the retention of the young sturgeon in the river is their hybridization with sterlet. However, the high growth rate and large food requirement make it necessary for all young sturgeon to migrate gradually downstream from the oligotrophic river to the sea. All sexually mature Russian sturgeon migrate into the Volga from the sea. Part of the large fish, distinguished by their good condition, enter the river in the spring, finish maturing during their ascent of the river, and spawn in June-July in the channel gravel beds. Greater numbers of potential spawners enter the Volga later in the season and with less mature sexual products. Their maturation is completed during the time of the rapid fall cooling of the water or in the following spring. This brood stock spawns in the spring of the following year at the low limit of optimal temperatures on flooded shore beds. In the lower reaches of the Volga the two parts of the spawning stock of sturgeon form a continuous run with constantly changing sizes, sexual conditions and degree of maturity of the fish. Prospects for reproduction of sturgeon in the regulated Volga are examined.

7953. Gal'nbek, A. I. 1961. THE APPEARANCE OF WINTERKILL IN THE KAMA RESERVOIR (1956-1958). (O VOZNIKNOVENII ZAMORHYKH YAVLENII V KAMSKOM VODOKHRANILISHCHE (1956-1958)). Tr Ural'sk Otd Gos Nauchn-Issled Inst. Ozernogo I Rechnogo Rybn Khoz 5: 195-199.; Referat. Zhur., Biol., 1963, No. 8I101. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80901. 1964.

A large drop in the level of the reservoir, entry of water containing decaying organic matter and heavy contamination from wastes of paper and chemical concerns are the main reasons for periodic mass deaths of fish. This is particularly apparent in the winter when, with fall in the water level, settling of the ice occurs and fish are squeezed by the ice or are cut off from the channel.

7954. Gusev, A. G. 1961. EFFECT OF INDUSTRIAL SEWAGE WATER ON RESERVOIR FISHERIES. (VLIYANIE PROMYSHLENNYKH STOCHNYKH VOD NA RYBNOE KHOZYAISTVO VODOKHRANILISHCH). Izvest Gos Nauchn-Issled Inst Ozernogo I Rechnogo Rybn Khoz 50: 411-428, 454. (English summ.); Referat. Zhur., Biol., 1963, No. 8I100. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80905. 1964.

The degree of contamination of reservoirs with sewage waters is determined by the amount and composition of the contaminants, the conditions of flow, the character of the reservoir itself, the rate of flow, the character of drop in water level, and the self-purifying action of the water. Contamination of waters not only has a directly unfavorable effect on the fauna and flora of the waters and on the settling of precipitates to the bottom of the body of water, but also changes the physical-chemical properties of the water (salinity, pH, hardness, turbidity). Discharge of petroleum products and toxic substances has a particularly deleterious effect. Sewage water is most damaging in the winter time, when there is an absence of atmospheric aeration. The Gor'kov and Kuibyshev Reservoirs are relatively pure bodies of water with local contaminations from large cities. The Cheboksar, Volgograd and Kama Reservoirs are heavily contaminated with petroleum products and toxic substances which considerably decrease fish productivity of the waters, impart an unpleasant taste and odor to the fish, and cause regular winterkills.

7955. Isakova-keo, M. M. 1959. RAISING LIVE FOOD IN PONDS FOR YOUNG OF SALMON AT LOW TEMPERATURES. (VYRASHCHIVANIE ZHIVYKH KORMOV V PRUDAKH DLYA MOLODI LOSOSYA PRI NIZKIKH TEMPERATURAKH). In: Trudy VI Soveshchaniya po Problemam Biologii Vnutrennikh Vod, 1957. (Proceedings of the Sixth Conference on the Biological Problems of Inland Waters 1957). Akad. Nauk SSSR: Moscow-Leningrad. 94-99.; Referat. Zhur., Biol., 1960, No. 35245. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80907. 1964.

It was shown that wintering ponds can be manured not only in the fall but also throughout the entire winter when the ponds are covered with ice. A sufficient amount of heaped manure maintains intensive bacterial growth. Breeding of Crustacea and Rotifera occurs in spite of low water temperatures (2-3° C.). Maintaining food-organisms in ponds during fall and winter can shorten the rearing period of young of salmon in the hatchery to 13-14 months.--Courtesy NSF (PL 83-480) 1963.

7956. Kuz'min, A. N. 1961. EXPERIMENTS ON THE FERTILITY OF WHITEFISH EGGS AFTER THE DEATH OF THE FEMALES. (OPYT OPLODTVORENIYA IKRY SIGOVYKH POSLE SMERTI SAMOK). Izvest Gos Nauchn-Issled Inst Ozernogo I Rechnogo Rybn Khoz 51: 60-64, 268-269. (English summ.); Referat. Zhur., Biol., 1963, No. 8I95. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80914. 1964.

One to 4 hours after destruction (section of the branchial arch) of cisco females, eggs were obtained from them and were inseminated with sperm from live males. Eggs were incubated in a Weiss apparatus at a temperature of 0.2-2.6° C. Eggs taken from fish 2-3 hours after death developed normally and gave viable progeny, while eggs taken from females 4 hours after death all died. Similar experiments were carried out with (Coregonus peled); at the end of incubation death of eggs inseminated 3 hours after death of the fish was 30.8%; among those inseminated 4 hours after death of the fish it was 70%. The remaining embryos of these batches developed normally at the end of incubation. The number of nonpregnated eggs in batches inseminated 3, 4 and 6 hours after death of the females were 18.2, 49.5 and 100%, respectively. The membranes of eggs taken 4 hours after death of the female were weakly adhesive, and 6, 8 and 10 hours after death were lacking in adhesiveness. Eggs taken 3 hours after death of the fish were characterized by normal adhesiveness.

7957. Levanidov, V. Ya. 1962. STOCKS OF AMUR SALMON AND HYDROELECTRIC CONSTRUCTION. (ZAPASY AMURSKIKH LOSOSEI IN GIDROSTROITEL'STVO). Izvest Tikhokeansk Nauchn-Issled Inst Rybn Khoz I Okeanog 48: 133-140; Referat. Zhur., Biol., 1963, No. 8I94. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80917. 1964.

A short analysis is given of the present condition of stocks and the character of the spawning areas of pink salmon (Oncorhynchus gorbuscha), summer and autumn chum salmon (Oncorhynchus keta), and their present distribution. Hydroelectric construction on the Amur in the upper and middle courses will affect the stock of Amur salmon very little, while in the lower course it will very seriously damage the stock. In the Ussuri basin hydroelectric construction on the tributaries will not damage the stock seriously if the sites for the dams are selected with consideration for the interests of salmon fishing, and if fish culture measures are properly carried out.

7958. Levanidov, V. Ya. 1962. USE OF A VITAL STAIN FOR MARKING PACIFIC OCEAN SALMON YOUNG FOR THEIR QUANTITATIVE CENSUSING. (O PRIMENENII VITAL'NOGO OKRASHIVANIYA MAL'KOV TIKHOOKEANSKIKH LOSOSEI DLYA IKH KOLICHESTVENNOGO UCHETA). Izvest Tikhookeansk Nauchn-Issled Inst Rybn Khoz I Okeanog 48: 206-207; Referat. Zhur., Biol., 1963, No. 12I36. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80918. 1964.

It is suggested that the young be stained with neutral red in concentrations of 1:75,000 and 1:150,000, and that they be kept in this solution for a period of 15-30 minutes. The young acquire a reddish coloration, which is particularly intensive in all the fins. The color remains unchanged for a period of 2 weeks. The stained young fish are clearly distinguished from the unstained ones even at night, and they remain fully viable. The stained young are released at a distance of 0.5 km from the places where trap nets are set. The number of young is computed by the following formula:

$$\text{total number of young at spawning grounds} = \frac{\text{total number of marked} \times \text{total number of unmarked captured}}{\text{number of captured marked}}$$

Results obtained by the use of trap nets showed a 1.5-2-fold increase in the concentration of young fish in comparison with results obtained by previous methods, a circumstance which is explained by the irregularity of the downstream movement of the fish and also by the fact that they concentrated in upper parts of the water.

7959. Malikova, E. M. 1962. REARING YOUNG SALMON ON THE ARTIFICIAL FOOD KRT-III. (VYRASHCHIVANIE MOLODI LOSOSYA NA ISKUSSTVENNOM KORME KRT-III). Gidrobiol Issled Tartu 3: 341-343.; (Estonian and German Summ.); Referat. Zhur., Biol., 1963, No. 12I76. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80920. 1964.

The rearing of salmon young on the vitaminized food mixutre KRT-III with antibiotics gave the most rapid growth, a good prophylactic effect with respect to epidemics, as well as high-quality zoological characteristics of immature fish. The use of this food permits an increase in the rate of stocking of salmon in ponds up to 1000 per m^2, and also the rearing of salmon to the downstream migration stage in one year.

7960. Mel'nikova, M. N. 1962. PROCEDURE AND RESULTS OF TAGGING SALMON KELTS IN THE VARZUGA RIVER IN 1958-1959. (METODIKA I RUZUL'TATY MECHENIYA VAL'CHAKOV SEMGI V R. VARZUGE V 1958-1959 gg). Nauchn Tekh Byul Gos Nauchn-Issled Inst Ozernogo I Rechnogo Rybnogo Khoz 15: 78-81; Referat. Zhur., Biol., 1963, No. 8I9. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80926. 1964.

In 1958-1959 at the Varzuga fish hatchery kelts were tagged with a celluloid planchet 0.6 mm thick fastened with a rustproof wire (0.3-0.4 mm) to the dorsal fin. Four hundred four specimens (265 females and 139 males) were tagged. The first tagged kelts were caught immediately after tagging in the pro-estuarine region of the Varzuga River, after which they were caught up to the end of July in the White Sea, but the main portion of the tagged salmon were caught during runs into the river at second spawning. The total return of tagged specimens was up to 17.4%, in the Varzuga estuary up to 10.3%.

7961. Peng, Seng Heng. 1962. AN EXPERIMENT ON THE PROPAGATION OF RAINBOW TROUT IN THE KOREAN PEOPLE'S DEMOCRATIC REPUBLIC. (OPYT RAZVEDENIYA RADUZHNOI FORELI V KOREISKOI NARODNO-DEMOKRATICHESKOI RESPUBLIKE). Sb Dokl Na II Plenume Komis Rybokhoz Issled Zap Chasti Tikhogo Okeana Moscow Pishche Promizdat 216-225; Referat. Zhur., Biol., 1963, No. 12I77. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80932. 1964.

A study was made of the results of fertilization in relation to the time which elapsed from the moment of taking sperm and roe to the time of fertilization and also of the percentage of hatching and sizes of eggs obtained from 2-, 3-, and 4-year-old breeders. Yield of larvae from 3- and 4-year-olds was about 92%, and their rate of survival about 70%, and from 2-year-olds about 69 and 65%, respectively. In the rearing of yearlings an average weight of 16.6 and 23.5 g was obtained by the end of the year over a period of several years; the food coefficient was 2.9 and 3.2, and the fish production was 3 metric tons/ha. The average weight of fish of age 1+, at a stocking rate of 1.2-2.6 fish per m^2, was 395 g, and fish production was 7 metric tons/ha. At a stocking rate of 5.1-12.5 fish per m^2, the average weight was 22.4 g and fish production was 9 metric tons/ha. The fishes were fed mainly on meal made from leaves of Ulmus maeracorpa. It was noted that the breeding of trout was more profitable than that of carp.

7962. Pomerantsev, G. P. 1961. SPECIFICITY OF CONDITIONS FOR FORMATION OF FISH PRODUCTIVITY IN THE KAMA RESERVOIR. (SPETSIFICHNOST' USLOVII FORMIROVANIYA RYBOPRODUKTIVNOSTI KAMSKOGO VODOKHRANILISHCHA). Tr Ural'sk Otd Gos Nauchn-Issled Inst Ozernogo I Rechnogo Rybn Khoz 5: 8-37; Referat. Zhur., Biol., 1963, No. 8I90. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80935. 1964.

The Kama Reservoir, as a result of its hydrological, hydrochemical and water level regimes, has few possibilities for development of fishing and increasing its fish productivity. With the exception of individual sections, plankton and benthos grow poorly in the reservoir. In the first year a sharp rise was observed in the development of benthos; however, because of the sharp drop in level, settling of the ice, discharge of humic waters, the benthic fauna soon diminished. Oligochaetes predominated in the benthos. The principal fish in the reservoir were pike, zander, and bream. Wild carp and pond carp (Cyprinus carpio) are not promising material for the Kama Reservoir because of its low food supply and poor conditions for wintering. Seasonal concentrations of fish were most prominent in commercial fishing. Fishing conditions were unfavorable, since the bed of the reservoir was not cleared. It is proposed that the embankment sections of the reservoir be used as feeding areas for carp or other fish. 30 references.

7963. Popova, O. A. 1962. SOME DATA ON THE FOOD OF COD IN THE NEWFOUNDLAND REGION OF THE NORTHWESTERN ATLANTIC. (NEKOTORYE DANNYE PO PITANIYU TRESKI V N'YUFAUNDLENDSKOM RAIONE SEVERO-ZAPADNOI ATLANTIKI). In: Sovetskie rybokhozyaistvennye issledovaniya severo-zapadnoi chasti Atlanticheskogo okeana. (Soviet fisheries research in the northwestern part of the Atlantic Ocean). Rybn. Khoz.; Moscow. 235-253.; (English summ.); Referat. Zhur., Biol., 1963, No. 12I49. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80936. 1964.

Data were collected in 1959 and 1960. In the shallow waters of Labrador and Newfoundland cod fed mainly on spawning capelin (Mallotus villosus villosus). Sand eels were the basic food in the Grand Bank region, and various representatives of cod in the waters of Nova Scotia. On the Flemish Cap banks, in Cabot Strait, and on the slopes of the Grand and Newfoundland Banks the basic food consisted of deep-sea fishes: Paralepis rissoi, anchovies, as well as amphipods and euphausiids. Benthic organisms (crabs and molluscs) were eaten by cod in the shallows of the Grand Bank and Hamilton Bank, and in the waters of Nova Scotia. The best feeding conditions occur during the summer in the Newfoundland shallows as well as in the southern part of the Grand Bank, where large and stable concentrations of capelin and sand eels were observed. The cod of this region had the greatest fat content. A list of organisms found in cod stomachs is given.

7964. Postolakii, A. I. 1962. BIOLOGY OF THE COD OF THE LABRADOR AND NEWFOUNDLAND REGIONS. (BIOLOGIYA TRESKI RAIONOV LABRADORA I N'YUFAUNDLENDA). In: Sovetskie rybakhozyaistvennye issledovaniya severozapadnoi chasti Atlanticheskogo okeana. (Soviet fisheries research in the northwestern part of the Atlantic Ocean). Rybn. Khoz.: Moscow. 345-354. (English summ.); Referat. Zhur., Biol., 1963, No. 12I30 (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80937. 1964.

In order to elucidate the occurrence and characteristics of the population, a study was made of the size-age composition, growth rate, number of vertebra, sizes of otoliths, infestation with parasites, and the time of maturation of cod captured in various areas of Labrador and Newfoundland. Analysis of all characteristics indicates the existence of 4 populations of cod which occur in the following regions: southern Labrador, northern Newfoundland banks and northern tip of the Grand Bank; banks of Flemish Cape; southeastern and northeastern parts of the Grand Bank; southwestern part of the Grand Bank.

7965. Reshetnikova, A. V. 1962. THE CHANGE IN THE BLOOD OF CARP (CYPRINUS CARPIO) DUE TO ICHTHYOPHTHIRIUS INFECTION. (OB IZMENENII KROVI SAZANA PRI ZARAZHENII IKHTIOFTIRIUSOM). Nauchn-Tekh Byul Gos Nauchn-Issled Inst Ozernogo I Rechnogo Rybn Khoz 15. 71-73. 1962; Referat. Zhur, Biol., 1963, No. 12I65. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80940. 1964.

The Hb concentration in 9-year-old carp of the Tsimlyansk Reservoir infected with Ichthyophthirius

was below normal. For a moderately virulent disease and a short period of infection, the Hb concentration in males was 8-9 g %, and in females 7-8 g %; for a severe infection with Ichthyophthirius the Hb concentration was less than 1.5 g%; many (about 93%) immature erythrocytes were noted. The erythrocyte sedimentation rate in fish with a low intensity of infection increased by a factor of 2-4, and in heavily infected fish by a factor of 6-10 in comparison with the normal value. Lymphocytes normally represent from 80-94% of the total number of leucocytes; monocytes represent 1-9%, and neutrophils 0.5-13%. With a low infection the amount of lymphocytes falls to 60%, that of neutrophils rises up to 30%, and that of monocytes up to 14%. With heavy infection lymphocytes comprise 30% and neutrophils 64% of the total number of leucocytes.

7966. Ryzhenko, M. I. 1962. BIOLOGICAL STUDIES CONDUCTED ON THE SUBMARINE "SEVERYANKA." (BIOLOGICHESKIE ISSLEDOVANIYA, PROVEDENNYE NA PODVODNOI LODKE "SEVERYANKA"). Tr Okeanog Komis Akad Nauk SSSR 14: 95-102.; Referat. Zhur., Biol., 1963, No. 7D209. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80941. 1964.

Equipment which allows biological observations to be carried out on board is described. From research in the Barents Sea and the North Atlantic the following are described: observations of euphausiid vertical distribution; feeding characteristics, density, structure of schools and the behavior of cod (Gadus morhua L.) and haddock (Melanogrammus aeglefinus L.); behavior of hibernating herring (Clupea), Micromesistius, and skipper (Scomberesox saurus).

7967. Sidorenko, I. N. 1962. THE FOOD OF COD IN WEST GREENLAND. (PITANIE TRESKI V VODAKH ZAPADNOI GRENLANDII). In: Sovetskie rybokhozyaistvennye issledovaniya severo-zapadnoi chasti Atlanticheskogo okeana. (Soviet fisheries research in the northwestern part of the Atlantic Ocean). Rybn. Khoz.: Moscow. 255-261. (English summ.); Referat. Zhur., Biol., 1963, No. 12I50. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80943. 1964.

The food of 12,347 specimens of cod, captured between April and Nov. 1957-60, was investigated. Sand eels form the main basis of nourishment in summer, fall, and spring; capelin (Mallotus villosus) and other fishes are found more rarely in the food. Euphausiids were very important; somewhat less important were shrimp, crabs and amphipods, echinoderms, polychaetes, and molluscs. The variety of animals found in the food of cod indicates that less preferred food items play a significant role in the nutrition of cod. This is explained by the irregularity in the approach of basic food objects --capelin and sand eel--to these areas. A fall and a spring feeding period were observed.

7968. Timofeeva, N. A. 1960. A STUDY OF THE BLOOD OF HYBRIDS OF GREAT STURGEON (HUSO HUSO) WITH STERLET (ACIPENSER RUTHENUS), IN COMPARISON WITH THE PARENT SPECIES. (IZUCHENIE KROVI GIBRIDA BELUGI SO STERLYAD'YU V SRAVNENII S ISKHODNYMI VIDAMI). Tr Saratovsk Otd Gos Nauchn-Issled Inst Ozernogo Rybn Khoz 6: 178-191.; Referat. Zhur., Biol., 1963, No. 12I64. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80950. 1964.

A study was made of the Hb concentration and blood composition in relation to age, feeding season, and differences in feeding in hybrids of great sturgeon and sterlet (both reciprocal forms) and in parent species. The highest Hb concentration was established for sterlet, and the lowest for great sturgeon; both hybrid forms are characterized by intermediate amounts of Hb content. In sterlet, obtained from wintering ponds, the Hb concentration was 55.5-55.7%, and in hybrids it was 44-51.3%; in the form sterlet female X great sturgeon male the Hb concentration was higher than in the other hybrid. The increase in the Hb concentration in overwintering forms occurred in spite of the fact that the conditions for the feeding of the fish were extremely unfavorable during the winter, and the low temperature was incapable of stimulating an increase in the metabolic rate of the organism. In sterlet the number of erythrocytes per ml of blood fluctuated between 320,000 and 290,000 during the growing period. The largest number was found in the great sturgeon, the smallest in the sterlet, and an intermediate value in the hybrids. The hybrid offspring of sterlet female X great sturgeon male is characterized by more elongated erythrocytes in comparison with other forms. During overwintering there occurs in sterlet and also in the hybrid offspring of sterlet female X great sturgeon male a decrease in the number of lymphocytes at the expense of an increase in the number of monocytes and polymorphonuclear leucocytes. The white blood cell count in the hybrid of great sturgeon frmale X sterlet male varies slightly during overwintering. In experiments with the great sturgeon it was established that the number of erythrocytes and the Hb concentration in the blood varied according to the quality of the food. In the great sturgeon the best blood indices were obtained through feeding with fish flesh, and in sterlet through feeding with a mixture of enchytraeids and chironomids. In the absence of chironomids from the food there occurs in both hybrid forms an increase of blood monocytes and polymorphonuclear leucocytes. Thrombocytes were demonstrated in sterlet as well as in the hybrid offspring of sterlet female X great sturgeon male. In great sturgeon and in the hybrid offspring of great sturgeon female X sterlet male thrombocytes were absent, although in these hybrids there were dense aggregates of cells with oval nuclei and a small amount of protoplasm, which may apparently be classed in the category of thrombocytes. The sizes of blood leucocytes are not constant.

7969. Tolstikhina, O. A. 1960. OUTBREAK OF CARP DISEASES IN THE UZHUR FISH HATCHERY. (ZABOLEVANIYA KARPOV V UZHURSKOM RYBOPITOMNIKE). Nauchn-Tekh Byul Gos Nauchn-Issled Inst Ozernogo I Rechnogo Rybn Khoz 12. 52-53;

Referat. Zhur., Biol., 1963, No. 12I93. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80952. 1964.

The following diseases were observed for the first time in 1957 in carp and bream of the Uzhur fish hatchery: redspot disease, trichodianosis, Dactylogyrus infestation, costiasis, and sanguinicoliasis. These diseases are some of the main causes of retarded growth in carp and of heavy (up to 90%) losses of yearlings during overwintering.

7970. Troitskaya, V. I. 1961. FISH FAUNA OF THE KAMA RESERVOIR AND SOME FEATURES OF ITS FORMATION IN 1956 TO 1959. (IKHTIOFAUNA KAMSKOGO VODOKHRANILISHCHA I NEKOTORYE CHERTY EE FORMIROVANIYA V 1956-1959 GODAKH). Tr Ural'sk Otd Gos Nauchn-Issled Inst Ozernogo I Rechnogo Rybn Khoz 5: 176-194.; Referat. Zhur., Biol., 1963, No. 8I89. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80956. 1964.

In 1957 the formation of a fish fauna in the Kama Reservoir began. Stocks of Kama fish were supplemented with fish from the region flooded, part of the river rheophilic fish from the upper part of the rivers. In the first years the catch of bream, pike and zander increased considerably as a result of the flooding of vast meadow sections, favorable for spawning of these fish. Most of the fishing was for pike (50% of the catch), roach, perch, ide (Leuciscus idus), and burbot. Commercially valuable migratory fish [great sturgeon (Huso huso), Russian sturgeon, shad and Caspian inconnu (Stenodus l. leucichthys)] were found very rarely. Contamination of the waters with sewage and the sharp yearly winter drop in the level have an unfavorable effect on the formation of the fish fauna. It is necessary to control the coarse fish (roach, perch) and limit the catch of pike and zander until the stock is completely built up.

7971. Tyurin, P. V. 1961. EFFECT OF THE WATER LEVEL REGIME IN RESERVOIRS ON THE FORMATION OF FISH STOCKS. (VLIYANIE UROVENNOGO REZHIMA V VODOKHRANILISHCHAKH NA FORMIROVANIE RYBNYKH ZAPASOV). Izvest Gos Nauchn-Issled Inst Ozernogo I Rechnogo Rybn Khoz 50: 395-410, 454; (English summ.); Referat. Zhur., Biol., 1963, No. 8I88. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80957. 1964.

The water level of reservoirs has a decisive effect on the quality and quantity of fish in the reservoir. In lowland reservoirs the commercially valuable fish are spring-spawning, and their spawning occurs in shallow water (0.2-1.0 m deep) with soft vegetation (bream, carp, pike-perch, pike and blue bream (Abramis ballerus)). Water reservoirs are divided as follows according to the type of drop in level: 1. Reservoirs with a maximum spring level and an appreciable summer-fall-winter drop in level (Rybin, Tsimlyan, Mingechaur, Kremenchug). Such a regime in principle is favorable for fish raising. 2. Reservoirs with a stable high level during the open period and a considerable winter drop (Kuibyshev, Gor'kov, Kama, Khakhov, Novosibirsk and Kairak-Kum). The regime of these reservoirs is unfavorable for natural breeding of stocks of commercially valuable fish. Such a water level regime favors the development of fish of little value. 3. Reservoirs with a stable level throughout the year (Dneprov, Volgograd). This is most favorable for fish raising. The winter fall in level in the first two types of reservoirs must occur regularly during the whole winter. During the spawning period it is necessary to prevent temporary daily fluctuations in level. In order to replenish the species composition of the fish in reservoirs with a winter drop and reservoirs with a stable level it is recommended that whitefishes with fall spawning be introduced [ripus (Coregonus albula ladogensis), peled (Coregonus peled) and lake whitefish (Coregonus lavaretus)].

7972. Walburg, Charles H. (N. Central Reservoir Investigations, Yankton, S.D.). 1964. FISH POPULATION STUDIES, LEWIS AND CLARK LAKE, MISSOURI RIVER, 1956 to 1962. U. S. Fish and Wildlife Service, Special Scientific Report-Fisheries 482. p. 1-26. Illus. Map.

Studies on 33,000-acre Lewis and Clark Lake, a mainstem Missouri River reservoir, during the first 7 years of impoundment (1956-62) indicate that carp, river carpsucker, and white crappie were the most abundant fishes. Other major species (listed phylogenetically) were shovelnose sturgeon, shortnose gar, smallmouth buffalo, channel catfish, black crappie, sauger, and freshwater drum. Relative abundance estimates, based on experimental gill net, frame net, and shore seine catches in the months of June, July, and August by South Dakota Department of Game, Fish, and Parks personnel in years 1956 through 1961, and by Bureau of Sport Fisheries and Wildlife personnel in 1962, suggest that total numbers of most species have declined since 1956. Fish reproduction and growth rates have also declined during the same period. Young-of-the-year gizzard shad were the dominant forage fish. The silvery minnow abundant following impoundment, was replaced by the emerald shiner. (Auth.)

7973. Yakoveleva, A. N. 1962. CHARACTERISTICS OF FORMATION OF STOCKS OF COMMERCIAL FISH IN THE VOLGOGRAD RESERVOIR. (OSOBENNOSTI FORMIROVANIYA ZAPASOV PROMYSLOVYKH RYB V VOLGOGRADSKOM VODOKHRANILISCHE). Nauchno-Tekh Byul Gos Nauchn-Issled Inst Ozernogo I Rechnogo Rybn Khoz 15, 3-6; Referat. Zhur., Biol., 1963, No. 8I91. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80960. 1964.

Commercial fish in the Volgograd Reservoir derive mainly from fish of the Volga and waters of the accessory system. The species composition of fish catches in the reservoir remained the same, but significant changes occurred in relative quantities. Thus, the proportion of bream and zander decreased, while white bream and roach increased. In the first 2 years the reservoir was filled; during the repro-

duction period of the spring-spawning fish a sharp decrease in level occurred, and because of this the shallow waters (spawning grounds of the fish) dried and premature downstream migration of the brood stock and larvae occurred, which was reflected in the effectiveness of reproduction. In river sections above the reservoir favorable conditions were created for the existence of rheophilic fish (sterlet, Russian sturgeon). These fish entered the reservoir for feeding.

7974. Zaryanova, E. B. 1962. FORMATION OF STOCKS OF ZANDER AND PIKE IN THE VOLGOGRAD RESERVOIR IN THE FIRST YEARS OF ITS EXISTENCE (1959-1961). (FORMIROVANIE ZAPASOV SUDAKI I SHCHUKI V VOLGORADSKOM VODOKHRANILISHCHE V PERVYE GODY EGO STANOVLENIYA (1959-1961 gg.). Nauchn-Tekh Byul Gos Nauchn-Issled Inst Ozernogo I Rechnogo Rybn Khoz 15: 6-9.; Referat. Zhur., Biol., 1963, No. 8I92. (Translation); Biological Abstracts, Vol. 45, No. 19, Abst. No. 80962. 1964.

Commercial stocks of zander were low and marked increases did not occur in the first years after the reservoir was built. The rate of catch was quite high and fishing was mainly based on the catch of sexually immature fish or 3- and 4-year-olds spawning for the first time. The coefficient of commercial survival also was low. Because of a decrease in the water level in the spring, premature downstream migration of larvae from the flood plain occurred which apparently caused retardation of growth and death of some of the young. In order to obtain the planned yield of zander it is necessary to prohibit their catch and to speed up introduction of spawning and rearing stations for young zander. Stocks of pike can completely provide for the production planned. The catch in 1960 increased in comparison with 1959; 4 - 6-year-old specimens (sexually mature) predominated in the catches.

7975. Halver, John E., Lynn S. Bates, and Edwin T. Mertz. (Dept. Biochem., Purdue Univ., Lafayette, Ind.). 1964. PROTEIN REQUIREMENT FOR SOCKEYE SALMON AND RAINBOW TROUT. In: 48th Annual meeting of the Federation of American Societies for Experimental Biology, Chicago, 1964. Fed. Proc., 23(2 Pt. 1): 397. 1964.--Abst. only.

7976. Tavolga, William N. (Amer. Mus. Nat. Hist., New York, N. Y.), and Jerome Wodinsky. 1963. AUDITORY CAPACITIES IN FISHES. PURE TONE THRESHOLDS IN NINE SPECIES OF MARINE TELEOSTS. Bull. Amer. Mus. Nat. Hist., 126(2): 179-239. Illus.; Biological Abstracts, Vol. 45, No. 19, Abst. No. 82427. 1964.

Single-tone intensity thresholds were obtained for 2 spp. of Holocentrus, and 1 each of Thalassoma, Eupomacentrus, Haemulon, Lutjanus, Epinepheles, Prionotus, and Equetus, representing 7 families. The technique was a modified shuttle-box utilizing avoidance conditioning. The animal was trained to swim across a shallow barrier upon hearing the test sound, and in so doing avoided a mild electric shock. Most spp. took 5-7 days, at 25 trials per day, to achieve a 90% criterion of avoidance. When the training was completed, the thresholds were obtained by lowering the sound pressure of the test tone with each successive avoidance in steps of 2 or 5 decibels. When the animal ceased to avoid, the sound pressure was raised at successive trials until avoidance recurred. The threshold was calculated from the data obtained. It appears that marine fishes are virtually deaf to frequencies of more than 2000 cps. The highest sensitivities are below 1000 cps. The detection of low frequencies appears to be quite efficient to 100 cps. and lower, which lends weight to the idea that the lateral line functions as a short-range obstacle and moving-object detector. (From Auth. summ.).

7977. Bridges, W. R., and Oliver B. Cope. (Fish-Pesticide Research Lab., U.S. Bur. of Sport Fish and Wildlife, Denver, Colorado). 1965. THE RELATIVE TOXICITIES OF SIMILAR FORMULATIONS OF PYRETHRUM AND ROTENONE TO FISH AND IMMATURE STONEFLIES. The Pyrethrum Post, Vol. 8, No. 1, pp. 3-5.

The acute toxicities of two formulations to rainbow trout, channel catfish, bluegill, and the stonefly (Pteronarcys californica) were determined under controlled laboratory conditions. Toxic effects were measured by the determination of Median Lethal Concentration (LC_{50}) for 24, 48, and 96-hour exposures. LC_{50} values for fish ranged from 23 to 96 µ. g. /1; for stoneflies, I·0 to 2900 µ. g. /1. The rotenone formulation was I·8 to 3·2 times more toxic to fish than the pyrethrum formulation, but the pyrethrum formulation was 141 to 290 times more toxic to stoneflies. (Auth. summ.).

7978. Fraga de Azevedo, J., and Lidia de Medeiros. (Inst. Trop. Med., Lisbon, Portugal). 1963. MOLLUSCICIDAL ACTION OF AN ANGOLA PLANT, SECURIDACA LONGIPEDUNCULATA FRESEN, 1837. PRELIMINARY NOTE. (L'ACTION MOLLUSCICIDE D'UNE PLANTE DE L'ANGOLA, LA SECURIDACA LONGIPEDUNCULATA FRESEN, 1837. NOTE PRELIMINAIRE). Bull. Soc. Pathol. Exot., 56(1): 68-76. (English summ.); Biological Abstracts, Vol. 45, No. 19, Abst. No. 83457. 1964.

Extracts of Securidaca longipedunculata (Poligalaceae) are used by the Africans of Angola as a fish poison, as soap, as a diuretic, purgative, anthelmintic, hemostat, against snake bites and rabies, and for suicide. Extracts of the roots are highly toxic for the fish Tilapia natalensis and the snail Taphius glabratus due to their saponins. Its study as a molluscicide is recommended.--N. D. Levine.

7979. Moye, W. C. (Shell Develop. Co., Modesto, Calif.)., and W. H. Luckmann. 1964. FLUCTUATIONS IN POPULATIONS OF CERTAIN AQUATIC INSECTS FOLLOWING APPLICATION OF ALDRIN GRANULES TO SUGAR CREEK, IROQUOIS COUNTY, ILLINOIS. Jour. Econ. Entomol., 57(3): 318-322; Biological Abstracts, Vol. 45, No. 20, Abst. No. 85055. 1964.

An opportunity to study the effects of aldrin on a

small Mid-western stream occurred in November 1960, when a block of approximately 23,000 acres of farmland near Milford in Iroquois County, Illinois, was treated with aldrin at a dosage of 20 lb of 10% granules/acre. A 6-mile-long segment of Sugar Creek flowing through the area was subjected to contamination during aerial application of the granules. The stream was sampled for some species of Ephemeroptera, Trichoptera, Elmidae (Coleoptera), and Chironomidae (Diptera) up to 19 months after treatment. Of the 4 aquatic taxa studied, only 1, Elmidae, appeared unaffected by the treatment. Species of Ephemeroptera were severely reduced. The 2 remaining taxa, Trichoptera and Chironomidae, increased the summer following treatment but by the second spring after treatment populations of both taxa were similar in treated and untreated portions of Sugar Creek. A great number of fish were killed following application of the insecticide but a collection made 7 months later showed this stream contained a diversity of species and sizes of fish. The results of this study indicate that a single application of 2 lb of aldrin/acre severely reduced numbers of aquatic insects and fish, but their recovery was rapid and the treatment probably caused no permanent damage to fish and most stream invertebrates. (Authors)

7980. Gordeev, O. N. 1962. FEATURES OF THE FAUNA IN DYSTROPHIC KARELIAN RESERVOIRS AND PROBLEMS ON THEIR ECONOMIC EXPLOITATION. (OSOBENNOSTI FAUNY DISTROFNYKH VODOEMOV KARELII I VOPROSY IKH KHOZYAISTVENNOGO ISPOL'ZOVANIYA). In: Biologiya vnutrennykh vodoemov Pribaltiki. (Biology of inland reservoirs of the Baltic region). Akad. Nauk SSSR: Moscow-Leningrad. 196-205; Referat. Zhur., Biol., 1963, No. 2D306. (Translation); Biological Abstracts, Vol. 45, No. 20, Abst. No. 85084. 1964.

A total of 96% of Karelian lakes are of the dystrophic type (permanganate oxidizability 20 to 40 mg per liter O_2, bichromate oxidizability 40 to 70 mg per liter O_2, pH 4.9 to 6.8, 02 deficit in the benthonic layer). Desmid algae, as well as a number of Cladocera, Copepoda and Rotatoria, are either weakly represented or totally absent; the biomass of benthos is less than 6 to 14 kg/ha; mollusks are depressed; Amphipoda, Mysidae and Astacidae are absent; chironomids and, in part, Oligochaeta predominate. Perca, more rarely Rutilus rutilus and Esox lucius, persist in strongly humified lakes. Periodic liming and fertilization improve the living conditions in the lakes and render them suitable for stocking Abramis brama and Coregonus albula.

7981. Isakova-keo, M. M. 1962. RESULTS OF EXPERIMENTS ON THE DEVELOPMENT OF FOOD SUPPLY FOR THE YOUNG OF SALMON IN PONDS AT LOW TEMPERATURES. (REZUL'TATY OPYTOV PO SOZDANIYU KORMOVOI BAZY DLYA MOLODI LOSOSEI V PRUDAKH PRI MIZKIKH TEMPERATURAKH). Tr Petergofsk Biol Inst Leningradsk Gos Univ 19. 136-148.; Referat. Zhur., Biol., 1962, No. 9I57. (Translation); Biological Abstracts, Vol. 45, No. 20, Abst. No. 85091. 1964.

Results of work done at the Pelcha fish farm in 1954-58 are presented. Experiments with pond fertilizers conducted during the autumn flood gave positive results. After the fish were removed and the ponds filled, it was found that a considerable number of food organisms remained on the pond beds. Zonal fertilization of ponds creates conditions for the development of various organisms, and application of fertilizer does not disturb the O_2 regime. Young fish, released during spring in ponds abounding with small food organisms, increased their weight 4 - 5-fold within 1 month. Zonal fertilization of wintering ponds ensures development of food organisms during autumn-winter and early spring periods. Year-round production of the food supply enhances spring-summer growth of young with greater body weight, and permits their conditioning in wintering ponds for the downstream migration.

7982. Kiselev, I. V. 1962. CYPRINID HYBRIDS AS OBJECTS OF POLYCULTURE IN PONDS. (GIBRIDY KARPOVYKH RYB KAK OB'EKTY POLIKUL'TURY V PRUDAKH). Tr Soveshch Ikhtiol Komis Akad Nauk SSSR 14. 188-195.; Referat. Zhur., Biol., 1962, No. 9I54. (Translation); Biological Abstracts, Vol. 45, No. 20, Abst. No. 85097. 1964.

Hybrids from crossing pond carp with round carp (crucian carp), pond carp with Chinese goldfish (typical and mirror gold hybrids) and round carp with Chinese goldfish (cyprinid hybrids) are perfectly viable and possess high commercial qualities. The food supply on carp farms is not fully utilized, and hybrids can be its consumers. Natural fish production of feeding ponds can be increased 11/2 - 2-fold by cultivating hybrids of crucian carp and goldfish, together with pond carp. Cyprinid hybrid yearlings feed largely on phyto- and zooplankton and a number of other organisms which are eaten by pond carp only occasionally. The food spectra of pond carp and goldfish hybrids are similar but not synchronous. Artificial foods are well utilized by typical goldfish hybrids, somewhat poorer by mirror hybrids, and not at all by cyprinid hybrids.

7983. Kogan, A. V. 1963. THE DAILY RATION AND FEEDING RHYTHM OF THE BREAM ABRAMIS BRAMA (L.) IN TSIMLYAN RESERVOIR. (O SUTOCHNOM RATSIONE I RITME PITANIYA LESHCHA ABRAMIS BRAMA (L.) TSIMLYANSKOGO VODOKHRANILISHCHA). Vopr Ikhtiol 3(2): 319-325.; Biological Abstracts, Vol. 45, No. 20, Abst. No. 85100. 1964.

In July of 1959 and May, July, and Sept. of 1960, 7 periods of diurnal observations were conducted by means of 30-minute trawl samples every 4 hours. The stomach contents of 652 fish, or not less than 10 bream from each size group, age groups 7+ and 8+ (sexually mature), and 4+ and 5+ (sexually immature) were examined. The daily food ration varied within definite limits: in summer, in one region, these limits were 2.5 to 3.0% of the bream body weight. Since the bream is a benthophage depending on vision to find its food, it feeds during the daylight hours (on chironomid larvae, molluscs, etc.), but not at night. The minimum and maximum amounts of food

consumed depend on the length of the photoperiod in a given area of a water body and the nature of the bream's diet. The composition of the diet changes during the day: as the amount of illumination increases, chironomids and crustaceans predominate; as it decreases, the more sedentary forms such as molluscs predominate. Since the diurnal rhythm (unimodal and bi modal feeding intensities) and daily diet differ from area to area and seasonally, it is believed that they are of adaptive significance. --L. T. Penny.

7984. Kolesnikov, V. G., Yu. A. Torin., and N. Z. Khlystov. 1961. EFFECT OF OCEAN CONDITIONS ON THE DISTRIBUTION OF YELLOWFIN TUNA (NEOTUNNUS MACROPTERUS). (O VLIYANII OKEANOLOGICHESKIKH USLOVII NA RASPREDELENIE ZHELTOPEROGO TUNTSA), Tr Baltiisk Nauchn-Issled Inst Morsk Rybn Khoz I Okeanog 7. 31-33.; Referat. Zhur., Biol., 1962, No. 9I22. (Translation); Biological Abstracts, Vol. 45, No. 20, Abst. No. 85101. 1964.

Stocks of yellowfin tuna are for the most part confined to the upper zones of deep-water cliffs (to zones where the northern trade-wind current and the equatorial counter-current diverge, to coasts of baffling winds and precipitous depths, as well as to promontories and canyons). These zones can be identified by their phosphate and nitrate contents, as well as by the depth of stratified layers of the cliffs.

7985. Kol'gaev, A. M. 1962. PREVENTION OF EGG COAT DISINTEGRATION BY MEANS OF TANNIC ACID. (TANIN KAK SREDSTOV PROTIV RAZLOZHENIYA OBOLOCHEK IKRY OSENNEI KETY). Izvest Tikhookeansk Nauchn-Issled Inst Rybn Khoz I Okeanogr 48: 210-212; Referat. Zhur., Biol., 1962, No. 9I74. (Translation); Biological Abstracts, Vol. 45, No. 20, Abst. No. 85102. 1964.

Infected roe of autumn chum were treated with 1% tannic acid, 1% trypaflavine, 0.5% formaldehyde, and 0.5% potassium permanganate solutions. Positive results were obtained only by treatment of the roe with 1% tannic acid solution. Toughness of the egg coat increased 1.5 - 2-fold after treatment with this solution. The latter is recommended as a healing and prophylactic agent in the incubation of autumn chum roe.

7986. Kol'gaev, A. M., and A. P. Ivanova. 1962. BOTTOM INCUBATION EXPERIMENTS WITH THE SPAWN OF AMUR AUTUMN CHUM (ONCORHYNCHUS KETA). (OPYTY INKUBATSII IKRY AMURSKOI OZENNEI KETY V GRUNTE). Izvest Tikhookeansk Nauchn Inst Rybn Khoz I Okeanogr 48: 209-210.; Referat. Zhur., Biol., 1963, No. 7I62. (Translation); Biological Abstracts, Vol. 45, No. 20, Abst. No. 85103. 1964.

Experiments showed that bottoms, sand in particular, hindered the silting of spawn and the development of Saprolegnia.

7987. Konradt, A. G. 1962. EXPERIMENTAL CULTIVATION OF GRASS CARP IN PONDS OF THE LENINGRAD REGION. (OPYT VYRASHCHIVANIYA BELOGO AMURA V PRUDAKH LENINGRADSKOI OBLASTI). Nauchn-Tekhn Byul Gos Nauchn-Issled Inst Ozernogo I Rechn Rybn Khoz 15. 55-57; Referat. Zhur., Biol., 1962, No. 9I79. (Translation); Biological Abstracts, Vol. 45, No. 20, Abst. No. 85105. 1964.

Experiments were conducted in 1961 with grass carp (Ctenopharyngodon idella) (imported from China in 1960) in a pond with an area of 3.2 ha and a depth of about 1 m. The 3-m wide littoral zone was reed-grown and the entire pond area exhibited a vigorous growth of soft vegetation, especially pond weed. Dissolved O_2 content was found to fluctuate. Together with the grass carp were cultivated pond carp, sazan (a cyprinid fish), "peled" (Coregonus peled) orfe, as well as goldfish (Carassius auratus) which entered the pond during the high-water period. Grass carp were found to be tolerant of O_2 deficiency. Some specimens attained a weight of about 500 g by the time they were harvested.

7988. Konstantinova, N. A. 1962. ADAPTIVE CHANGES OF BIOLOGICAL CHARACTERISTICS OF THE FLOOD-PLAIN AND RIVER FISH OF LOWER VOLGA DURING VOLGOGARD RESERVOIR CONSTRUCTION. (PRISPOSOBITEL'NYE IZMENENIYA BIOLOGICHESKIKH POKAZATELEI POIMENNORECHNYKH RYB NIZHNEI VOLGI PRI OBRAZOVANII VOLGOGRADSKOGO VODOKHRANILISHCHA). Vopr Ikhtiol 2(2): 247-261. Illus.; Biological Abstracts, Vol. 45, No. 20, Abst. No. 85106. 1964.

Fish, inhabiting a river which has a well-developed flood-plain, are observed to adapt in diverse ways to extreme seasonal alterations of water conditions and to fluctuating food supplies. The bream and blue bream of the Lower Volga are characterized by a short intensive foraging excursion in the flood-plain and by highly pronounced peak gains in length and weight at the height of freshets in June. The white bream remain much longer on the flood-plain and long multiple spawning periods compensate for the high mortality rate of their young on the flood-plain. The zander and pike have certain predatory characteristics in common, and can find food almost year round, but they also have profound differences in adaptation to the various seasonal changes. When the Volgograd Reservoir was being filled in its first year, the conditions created by the prolonged freshet affected the habits and changed the biological characteristics of the fish in accordance with their adaptative characteristics. The process of intensive fat-accumulation, a biological indicator determining whether an organism is ready for reproduction and wintering, was accomplished in the short period when the freshet was at its height. When the spawning period lengthened, however, this process shifted to the end of the feeding and growing period. For the inhabitants of the main channel, the prolonged freshet was unfavorable. The feeding conditions for zander in the open zone of the reservoir grew worse and their growth rate dropped. --D. E. Bevan.

7989. Krylov, O. N. 1962. EFFECT OF HYDROCHEMICAL ENVIRONMENTAL FACTORS ON FISH

DISEASES IN THE KAMA RIVER AND KAMA RESERVOIR. (ZAVISIMOST' ZABOLEVANIYA RYB NA R. KAME I KAMSKOM VODOKHRANILISCHE OT GIDROLOGICHESKIKH I GIDROKHIMICHESKIKH FAKTOROV SREDY). In: Materialy XI Nauchnoi konferentsii. (Date of the 11th scientific conference). Leningradsk. Vet. Inst.: Leningrad. 42-45; Referat. Zhur., Biol., 1962, No. 9I42. (Translation); Biological Abstracts, Vol. 45, No. 20, Abst. No. 85107. 1964.

Many outbreaks of fish disease (particularly in bream) in the Kama River and Kama Reservoir have been traced to periods of low water level and to the harmful effect of waste waters on the hydrochemical conditions. Among fish of the Perm'Krasnokamsk region 95% were affected.

7990. Polyakov, G. D. 1962. ADAPTIVE INTERRELATIONSHIP BETWEEN THE VARIABILITY OF A FISH POPULATION AND ITS NUTRITION. (PRISPOSOBITEL'NAYA VZAIMOSVYAZ' IZMENCHIVOSTI POPULYATSII RYB S USLOVIYAMI PITANIYA). Tr Inst Morfol Zhivotnykh Akad Nauk SSSR 42. 5-63; Referat. Zhur., Biol., 1963, No. 18I25. (Translation); Biological Abstracts, Vol. 45, No. 20, Abst. No. 85129. 1964.

Using fingerling carp and single-aged young of other species as examples, it is shown that when there is a general change in living conditions, and corresponding changes in biological characteristics of the organism, the largest changes in biological characteristics occur among the most typical individuals. Thus, deterioration of feeding conditions and reduction in the average growth rate of a population of young fishes is most strongly apparent in fish of the commonest size. This leads to a characteristic change in the magnitude and structure of the length or weight distribution. The peak of the length-composition curve shifts to the left, producing positive asymmetry in the curve. In a fish population of many age groups, the modal length class usually represents individuals of a strong year-class with a retarded rate of growth, as well as individuals of a weak year-class preceding, or following the strong one, which also exhibit an extremely slow rate of growth. In a spawning population, deterioration of feeding conditions for individuals of the modal size group usually causes a very significant reduction in their fecundity in the following year. All changes in the magnitude and structure of the distribution of length, weight, and other characteristics of the fish ensure the preservation of the population and maintain its well-being, i.e. they are important group adaptations of the organisms to living conditions.

7991. Shcherbina, M. A. 1962. AMINO ACID CONTENT OF CRUDE PROTEIN IN POND FISH AND IN SOME FOODS. (SODERZHANIE AMINOKISLOT V SYROM PROTENIE PRUDOVYKH RYB I NEKOTORYKH KORMOV). Tr Vserosii Nauchn-Issled Inst Prudovogo Rybn Khoz 11: 5-13; Referat. Zhur., Biol., 1962, No. 9I63. (Translation); Biological Abstracts, Vol. 45, No. 20, Abst. No. 85137. 1964.

A study was made of the amino acid structure in 2nd year pond carp (Cyprinus carpio) and trout, in silkworm pupae, in hydrolytic yeast, and in 10 varieties of oil cake. Fifteen amino acids were isolated and their quantities determined. In many cases the conversion rate of total N to crude protein (6.25) did not agree with actual facts, which is accounted for by the considerable amount of free N-containing substances in the vegetable diet. On the basis of amino acid composition, all foods investigated, including soybean, linseed, cottonseed, and sunflower oil cakes were found to possess high nutrient value. Several nutriments were deficient in lysine and methionine. Of the oil cakes, that of soybeans was found to possess the highest nutritive value, and that of peanuts the lowest. The author suggests a rough scheme for combining oil cakes according to their amino acid content for the feeding of pond carp.

7992. Shcherbina, M. A., K. F. Sorvachev, and F. M. Sukhoverkhov. 1962. EVALUATION OF FISH FOODS ON THE BASIS OF THEIR AMINO ACID CONTENT. (OTSENKA KORMOV DLYA RYB PO AMINOKISLOTNOMU SOSTAVU). Vest Mosk Univ Biol Pochvovedenie 6. 20-25; Referat. Zhur., Biol., 1963, No. 14I85. (Translation); Biological Abstracts, Vol. 45, No. 20, Abst. No. 85138. 1964.

A determination was made of the amino acid content in Kursk carp, rainbow trout, and in more frequently used artificial foods. Greatest amount of total N was found in silkworm pupae, in castor, peanut, and soybean oil cakes, as well as in hydrolyzed yeast. Least amount of total N was found in linseed and tung oil cakes. The qualitative composition of amino acids of fish was similar to that of the food, although there were significant differences in quantitative composition, particularly in the amounts of lysin and methionine. Plant food was found to contain 2-3 times less lysin, and 5-8 times less methionine, than did fish protein. A combination of foods is proposed.

7993. Trofimova, T. I. 1962. EFFECT OF VITAMIN SUPPLEMENTS ON THE GROWTH OF RAINBOW TROUT (SALMO GAIRDNERI). (VLIYANIE VITAMINNYKH DOBAVOK NA ROST RADUZHNOI FORELI). Tr Vserosii Nauchn-Issled Inst Prudovogo Rybn Khoz 11: 13-18; Referat. Zhur., Biol., 1963, No. 9I59. (Translation); Biological Abstracts, Vol. 45, No. 20, Abst. No. 85146. 1964.

Addition of a solution of crystalline vitamin B_{12} in a dose of 30-40 µg/kg body weight to the fodder of rainbow trout fry and yearlings increased their weight by 28 and 85% respectively, compared with the controls. Addition to the food mix of 15% fish meal, containing in 1 kg 200-210 µg of vitamin B_{12}, increased the weight of yearlings by 26% compared with the controls. Incorporation of 4% dietary hydrolyzed yeast into the fodder of 2nd year trout increased their weight by 4-5% and reduced the loss of fodder per unit of growth increase by 12-15%. Addition of the fodder of an oil preparation of vitamin D_2 in a dose of 1000 I.U. per kg body weight of fish had no positive effect on the fish' growth. Growth was also unaffected by the addition of complexes of vitamin D_2 and B_{12}.

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